

Injuries in Hawai'i 2007-2011



**Injury Prevention and
Control Section**
Hawai'i State Department of Health



**INJURY
PREVENTION
ADVISORY COMMITTEE**

A SAFE HAWAII FROM THE MOUNTAINS TO THE SEA

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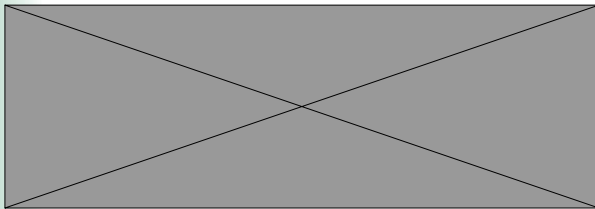
Message from Director of Health

The Hawaii State Department of Health is pleased to present “Injuries in Hawaii: 2007-2011”. This report contains the latest findings on the leading causes of injury mortality and morbidity in Hawaii .

Injuries are a major public health problem in Hawaii. They are by far the leading cause of death among children and young adults, and the fourth leading cause of death among state residents of all ages. Over the 5-year period covered in this report, a total of 3,355 residents died from their injuries.

The information in this report is for health and safety professionals, policy makers, and for everyone interested in protecting and improving the health of the people of Hawaii. The report includes descriptions of the geography and magnitude of the problem, trends, and populations at higher risk, and provides insight into some of the circumstances of these injury fatalities. It is crucial that good data be available to guide prevention and policy efforts to reduce injuries in Hawaii. This report is a first step. Please join the Department of Health, state and local agencies, and community organizations in working toward a safer Hawaii.

Additional copies of this report and other injury prevention information may be obtained by calling the Department’s Injury Prevention and Control Section at 808-733-9320.



Loretta J. Fuddy, ACSW, MPH
Director of Health
Hawai‘i State Department of Health

Introduction

What is the leading cause of death among Hawaii's children and young adults? The answer is not infectious disease or chronic diseases, such as cancer, but a public health problem that is chiefly non-medical in nature: injuries. The field of "injury" includes a diversity of events, ranging from unintentional motor vehicle crashes, drownings, falls, and poisonings, to assaults and suicides. Injuries currently account for more deaths among Hawaii residents aged 1 to 39 years than all other diseases combined. Injuries are also a leading cause of mortality in later ages, and for some outcomes (e.g. suicides) the highest risks are seen in the elderly.

There are risk factors for injuries, just as there are for certain diseases. To a large degree, many injuries can be prevented by reducing these risk factors, either to prevent the original cause (e.g. observing posted speed limits to prevent a crash) or the severity of the injury (e.g. utilizing seat belts). Injury risk factors generally take two forms: risks imposed by the physical environment in which the injury takes place, and perhaps more commonly, individual behaviors which place a person at risk. This report describes fatal injuries in Hawaii over the 2007-2011 period, with an emphasis on the environmental and individual risk factors involved. This includes the geographic mapping of fatal injuries, and the analysis of the demography and behaviors of the victims. For many types of fatal injuries, this involved linking the basic information contained on death certificates to more detailed information from crash reports, autopsy records, and criminal investigations. Nonfatal injuries over the 2007-2010 period are also described in this report. These far outnumber fatal injuries and in many respects impose a greater public health burden.

Although this report provides perhaps the most detailed summary of injuries currently available in the state, it was not intended to be completely comprehensive. Readers who are interested in further information on a given area are encouraged to contact the Injury Prevention and Control Section. This report is intended to bring attention to the problem of injuries, and to help inform and direct efforts to prevent fatal injuries in Hawaii.

Executive Summary

Fatal injuries are a major public health problem in Hawaii, constituting the 4th leading cause of death among state residents. Injuries are by far the leading cause of mortality among residents aged 1 to 40 years, accounting for more deaths in this age group than all other diseases combined. This report describes the magnitude of fatal injuries in the state, examines trends over time, and identifies geographic areas and segments of the population that are at increased risk of fatal injuries. This detailed report is a first step in bringing attention to the problem of fatal injuries, and providing information to design and direct injury prevention programs.

Although a leading cause of mortality, fatal injuries are relatively less common in Hawaii, compared to the rest of the United States. The age-standardized 5-year rate for unintentional injuries was 17% lower in Hawaii, a statistically significant difference. The homicide rate in Hawaii was roughly one-third of that for the rest of the U.S., while the suicide rates were more comparable.

A total of 3,355 residents were killed by injuries over the 5-year period. Most deaths (2,159, or 64%) were unintentional, 795 (24%) were suicides, and 112 (3%) were homicides. The intent could not be determined for 283 (8%) deaths. There was no trend in the annual rate of all fatal injuries, but there was a significantly increasing trend in the suicide fatality rate. The rate of deaths from unintentional injuries decreased significantly over the 2007 to 2010 period, but an increase in 2011 resulted in no clear trend over the entire 5-year period. The rate of homicides decreased significantly if only the 2008 to 2011 period was considered.

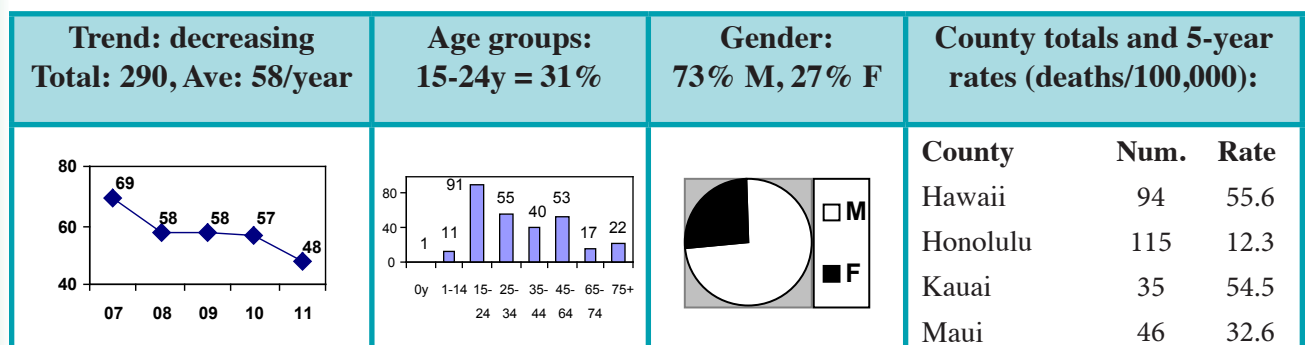
Although of a lesser severity, nonfatal injuries greatly outnumber fatal injuries, and constitute significant medical and financial burdens for the residents of Hawaii. For every resident who dies from an injury there are nearly 10 others who are hospitalized for nonfatal injuries, and another 118 who are treated and released from emergency departments (EDs). These ratios translate to 5,980 hospitalizations from nonfatal injuries and nearly 80,000 visits to EDs each year in Hawaii. There was a significantly increasing trend in the annual number of nonfatal injuries treated at hospitals in Hawaii, from 85,675 in 2007 to 87,111 in 2011.

Unintentional injuries, by main categories

Motor vehicle crashes, occupants (excluding motorcyclists)

Fatal injuries

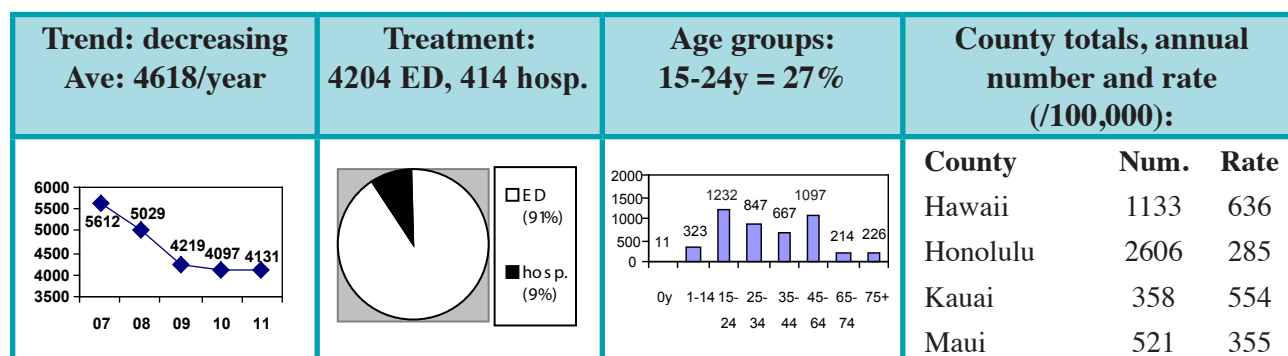
This category was the 4th leading cause of fatal injuries to Hawaii residents, averaging 58 deaths per year. About one-third (32%) of the victims were 15 to 24 years of age. Most (73%) of the victims were males. Fatality rates were significantly higher among Neighbor Island residents, compared to Oahu residents. The rates for residents of Hawaii and Kauai counties were particularly high, more than 4 times higher than that computed for Honolulu County.



More than half (57%) of the fatal crashes occurred during nighttime hours (7:29 p.m. to 5:31 a.m.), and 61% involved only a single vehicle. Lack of restraint use was a major risk factor for occupant fatalities, as less than half of the victims (47%) were wearing seat belts at the time of the crash. Restraint use was especially low among back seat passengers (25%). Speeding was the most common contributing factor, noted for 41% of the drivers. Substance use was also an important contributing factor, as 40% of the drivers involved in fatal car crashes tested positive for alcohol, almost one-quarter (23%) tested positive for drugs, and nearly half (49%) tested positive for either alcohol or drugs. The peak age of alcohol use among drivers was 21 to 24 years of age, as 56% tested positive for alcohol. More than half (56%) of the fatalities from car crashes were related to alcohol consumption by at least one driver involved in the crash.

Nonfatal injuries

There were more than 4000 nonfatal injuries among car occupants each year in Hawaii, with a decreasing annual trend. Most (91%) of the injuries were treated in EDs. Patient age was widely distributed, although 27% were 15 to 24 years of age, and this age group also had by far the highest rate of injury. There were nearly equal numbers of female (52%) and male (48%) patients.



The nonfatal injury rate for residents of Hawaii County was significantly higher than the rate for residents of any other county, while the rate for Honolulu County residents was significantly lower than that for residents of any other county. Almost all (95%) of the injuries were coded as “traffic”, or occurring on public roads. Patients were hospitalized for an average of nearly 1 week, with nearly \$46,000 in average medical charges per patient.

EMS data and 2007 linked data (EMS, DOT, HHIC, FARS, death certificates)

Most (86%) of the injured occupants treated by EMS were wearing seatbelts. Restraint use was strongly associated with EMS patient disposition, including a 7-fold increase in mortality rate among unrestrained occupants (4.5%) compared to those who wore seatbelts (0.6%). Probable alcohol use was noted for about 10% of the patients, and drinkers were significantly less likely to use seatbelts (71%, vs. 88% for other occupants). Linked data from 2007 showed unrestrained EMS patients had more than twice (2.3) the odds of an injury that required hospitalization or resulted in death, compared to restrained occupants, and more than triple (3.2) the odds of a fatal injury. These excess risks were statistically independent of patient age, gender, or the county of the crash.

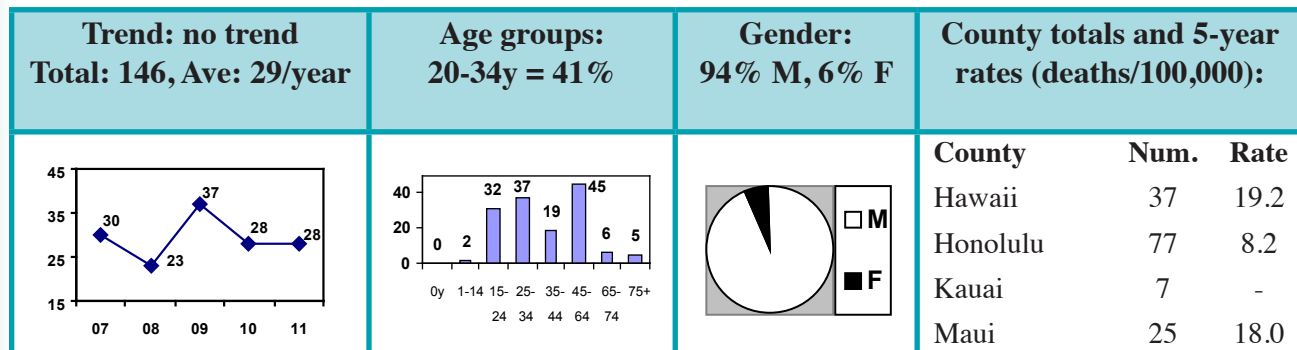
Hawaii Trauma Registry (toxicology data)

About one-third of the injured resident occupants in the HTR tested positive for alcohol (32%) or illicit drugs (35%). Considered together, more than half (52%, or 626) of the occupants tested positive for either alcohol or drugs. Occupants who were drinking were significantly younger than those who tested negative for alcohol (32 vs. 41 years, on average), more likely to be male (75% vs. 56%), and less likely to have used seat belts (46% vs. 63%).

Motor vehicle crashes, motorcyclists

Fatal injuries

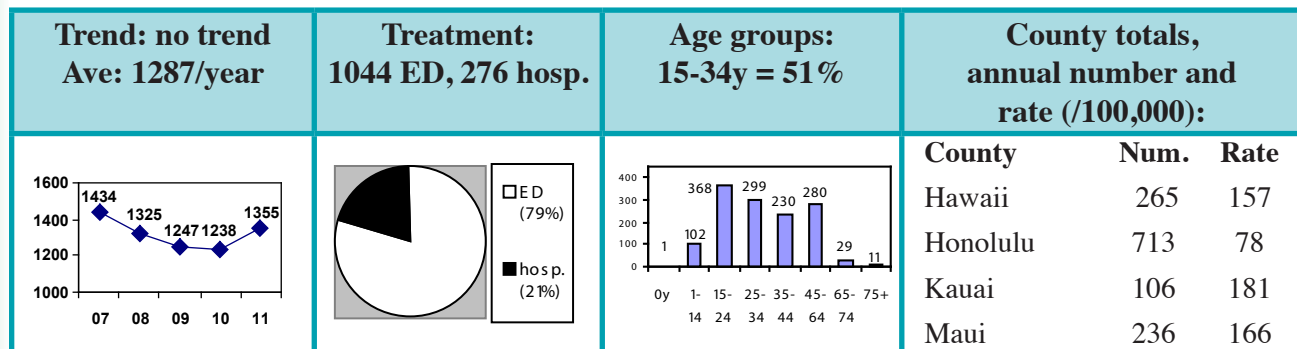
Deaths among motorcyclists were the 6th leading cause of fatal unintentional injuries in the state, accounting for 146 total deaths from 2007 to 2011. Nearly half (45%) of the victims were adult males 20 to 40 years of age. Most (73%) of the decedents were riding motorcycles; there were also 27 moped riders who were killed, including 16 over the 2010 to 2011 period. The 5-year fatality rates were significantly higher for residents of Hawaii and Maui counties compared to Honolulu County.



Almost half (46%) of the fatal crashes did not involve another vehicle, although that proportion was lower (26%) among the fatally injured moped riders. Only about one-fourth (27%) of all riders were wearing a helmet at the time of the crash, including only 7% of the moped riders. Nearly half (47%) of the decedents tested positive for alcohol, and 29% for illicit drugs. Alcohol use was most common among drivers who crashed during nighttime (66%) and among those in crashes without another motor vehicle (69%). About half (51%) of the fatally injured drivers did not have a valid motorcyclist license, and that proportion was significantly higher among those who had consumed alcohol (58%, vs. 44% among other drivers). More than one-half (58%) of the riders were noted to have been speeding at the time of the crash, a proportion that was higher among motorcyclists (62%) and those who crashed on Oahu (66%).

Nonfatal injuries

There was an decreasing trend in the annual number of nonfatal injuries among motorcyclists over the 2007 to 2010 period, but an increase in 2011. More than 1000 were treated in EDs each year and another 276 were hospitalized. Patient age was narrowly distributed, with 51% between 15 and 34 years of age. The peak age for rates of both ED visits and hospitalizations was among 20 to 24 year-olds. Most (83%) of the patients were males.



Although about half (54%) of the patients were residents of Honolulu County, residents there had significantly lower rates of nonfatal injuries than residents of any other county. Injury rates were approximately twice as high among residents of Neighbor Islands. Forty-four percent of the crashes did not involve a collision, but were due to loss of control by the rider. Three-fourths (75%) of the nonfatal injuries were coded as “traffic” related, or occurring on a public roadway, while 25% were in “non-traffic” environments, including off-road crashes. Nearly one-fifth (19%) of the patients who were injured in non-traffic crashes were 5 to 14 years of age. The average hospitalization was nearly 1 week in duration

and resulted in over \$51,000 in medical charges. About two-thirds (64%) of the hospitalized patients and one-quarter (23%) of those treated in EDs had fractures.

EMS data and 2007 linked data (EMS, DOT, HHIC, FARS, death certificates)

About 55% of the EMS Patients were riding motorcycles (55%), and 40% were riding mopeds (status unknown for 5%). About two-thirds (65%) of all riders were wearing a helmet. The proportion not wearing helmets was significantly higher, nearly doubled, among the moped riders (68%), compared to motorcycle riders (38%). Patient condition differed by helmet usage, as helmeted riders were significantly more likely to be transported with minor or moderate injuries (23%, compared to 19% for unhelmeted riders), and significantly less likely to be transported in critical condition (1.9% vs. 3.7%). The mortality rate among helmeted riders (2.5%, or 31 of 1249) was also significantly less than that among unhelmeted riders (4.6%, or 86 of 1879). Probable alcohol use was noted for about 12% of the patients, and alcohol users were significantly less likely to have worn helmets (14%, vs 41% among those with no alcohol use).

Linked data from 2007 showed the odds of sustaining an injury that required hospitalization or resulted in death were 40% higher among unhelmeted rides compared to helmeted riders, and the former also had more than twice the odds (2.2) of a fatal injury. The protective effects of helmet use were magnified if only motorcycle riders were considered. Unhelmeted motorcycle riders had twice the odds of an injury that required hospitalization or resulted in death, more than 3 times the odds of a fatal injury, and 3 times the odds of a TBI.

Hawaii Trauma Registry (toxicology data)

About one-fourth (26%) of the injured resident motorcycle/moped riders in the HTR tested positive for alcohol, including 21% (178) with BAC levels of 0.08 or greater, and 14% (117) with BAC levels of 0.16% or greater. Moped riders were significantly more likely than motorcyclists to have been drinking (31% vs 24%, respectively). More than half (54%, or 464) of the riders tested positive for either alcohol or drugs, including most (78%) of the 285 moped riders. Alcohol usage was 4 times more common among those who crashed during night time (54%) compared to those who crashed between 6:30 a.m. and 7:29 p.m. (14%).

Motor vehicle crashes, pedestrians

Fatal injuries

There was no statistically significant trend in the annual number of pedestrian fatalities, although the highest total occurred in 2007 (37 deaths). Senior-aged residents comprised 47% of the victims, and the fatality rates increased dramatically across the oldest age groups. Most (69%) of the victims were hit on Oahu, but there were no significant differences in county-specific fatality rates. Almost all (80%) of the victims who were 65 years or older were hit on Oahu, and the fatality rate for Oahu seniors was statistically comparable to that for seniors living on Neighbor Islands (36 vs. 22 deaths /100,000, respectively).

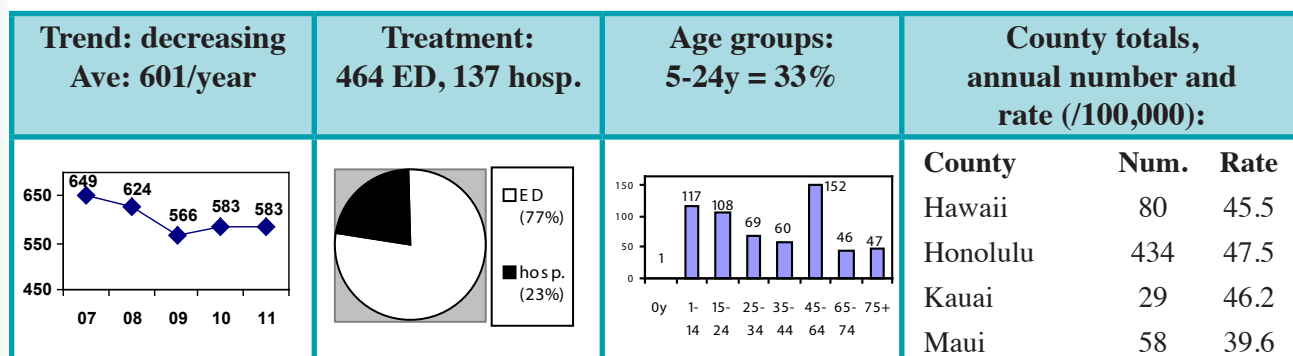
Trend: no trend Total: 130, Ave: 26/ year	Age groups: 65 y and older = 47%	Gender: 58% M, 42% F	County totals and 5-year rates (deaths/100,000):																																																			
<table><caption>Annual Pedestrian Fatalities (2007-2011)</caption><tr><th>Year</th><th>Fatalities</th></tr><tr><td>07</td><td>37</td></tr><tr><td>08</td><td>21</td></tr><tr><td>09</td><td>16</td></tr><tr><td>10</td><td>31</td></tr><tr><td>11</td><td>25</td></tr></table>	Year	Fatalities	07	37	08	21	09	16	10	31	11	25	<table><caption>Pedestrian Fatalities by Age Group</caption><tr><th>Age Group</th><th>Fatalities</th></tr><tr><td>0y</td><td>0</td></tr><tr><td>1-14</td><td>9</td></tr><tr><td>15-24</td><td>13</td></tr><tr><td>25-34</td><td>7</td></tr><tr><td>35-44</td><td>13</td></tr><tr><td>45-64</td><td>27</td></tr><tr><td>65-74</td><td>22</td></tr><tr><td>75+</td><td>39</td></tr></table>	Age Group	Fatalities	0y	0	1-14	9	15-24	13	25-34	7	35-44	13	45-64	27	65-74	22	75+	39	<table><caption>Gender Distribution of Pedestrian Fatalities</caption><tr><th>Gender</th><th>Percentage</th></tr><tr><td>Male (M)</td><td>58%</td></tr><tr><td>Female (F)</td><td>42%</td></tr></table>	Gender	Percentage	Male (M)	58%	Female (F)	42%	<table><tr><th>County</th><th>Num.</th><th>Rate</th></tr><tr><td>Hawaii</td><td>21</td><td>11.4</td></tr><tr><td>Honolulu</td><td>90</td><td>8.8</td></tr><tr><td>Kauai</td><td>4</td><td>-</td></tr><tr><td>Maui</td><td>15</td><td>10.5</td></tr></table>	County	Num.	Rate	Hawaii	21	11.4	Honolulu	90	8.8	Kauai	4	-	Maui	15	10.5
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There were 2 peak times for pedestrian fatalities: 27 crashes (21% of the total) occurred between 5:31 a.m. and 9:29 a.m., and 40 (31%) took place between 5:31 p.m. and 11:29 p.m. Only 34% of the victims were in a crosswalk at the time of the crash; a nearly equal proportion (35%) were hit on open stretches of roadway. The most common speed

zone was 25 miles per hour (45% of crashes). Almost two-thirds than half (63%) of the senior-aged victims were hit in 25 mph or slower zones, compared to 33% of pedestrians under the age of 65 years. According to FARS data from 2007 to 2010, more than one-quarter (26%) of the 84 fatally injured pedestrians tested positive for alcohol, and 25% had BAC levels of 0.08% or higher. Alcohol use was significantly higher among male victims (42%) compared to females (6%). The highest prevalence of alcohol use was seen among victims in the 21 to 34 year age group (70%, or 7 of 10), and the 35 to 54 year age group (52%, or 11 of 21). According to FARS data, 39% (33) of the pedestrian victims were in the roadway erroneously, most commonly by “improper crossing of roadway or intersection”, including jaywalking (21%, or 18 victims). Including the victims who tested positive for alcohol or drugs, 54% (or 45) of the pedestrians made an error that contributed to the crash. More than half (59%, or 52) of the 88 drivers made an error which contributed to the crash. Most commonly, they were described as “inattentive” (38%), failed to yield the right of way (25%), or were speeding (18%).

Nonfatal injuries

The annual number of nonfatal injuries to pedestrians generally decreased from 649 in 2007 to 583 in 2011. About one-quarter (23%) of the patients with nonfatal injuries were admitted to hospitals, the highest such proportion for any unintentional injury category. Patient age was widely distributed, but one-third (33%) were in the 5 to 24 year age group. This group also had the highest rate of nonfatal injuries that were treated in EDs, while senior aged residents had the highest rates of hospitalizations.



The rates of both ED visits and all injuries (ED visits combined with hospitalizations) were lowest for Maui County residents, although all county-specific rates were statistically comparable. Most (88%) of the nonfatal injuries were coded as “traffic” related, or occurring on a public roadway, while 12% were in “non-traffic” environments, including private roads, driveways and parking lots. Thirty percent of the patients injured in non-traffic crashes were in the 1 to 14 year age group. Patients were hospitalized for an average of 9 days, with nearly \$60,000 in medical charges. Hospitalizations accounted for most (73%) of total patient days and 87% of the \$9.4 million in total medical charges.

EMS data and 2007 linked data (EMS, DOT, HHIC, FARS, death certificates)

There were 2 peak periods for the time of the EMS-attended crashes, from 6:31 a.m. to 8:29 a.m. (13%, or 287 crashes), and from 2:29 p.m. to 7:29 p.m. (35%, or 788 crashes). The time distribution differed by patient age, as crashes with senior-aged pedestrians were more likely to occur during daytime hours (86%), compared to crashes involving pedestrians under 65 years of age (73%). Patient condition differed by age, as senior-aged pedestrians were significantly more likely to be transported to a hospital, compared to pedestrians under 65 years of age (85% vs. 79%, respectively), and had a significantly higher mortality rate (10.3%, or 47 of 456, vs. 3.6%, or 67 of 1855). The mortality rate was also significantly elevated among pedestrians who were hit during night time hours (7.4%, or 42 of 566), compared to those hit between 5:31 a.m. and 7:29 p.m. (4.1%, or 72 of 1747), despite the younger age distribution among the former. Probable alcohol use was noted for about 9% of the patients. Patients who had used alcohol had generally worse dispositions, and were more than three times as likely to require transport in critical condition, and nearly twice as likely to have died, compared to those who did not use alcohol.

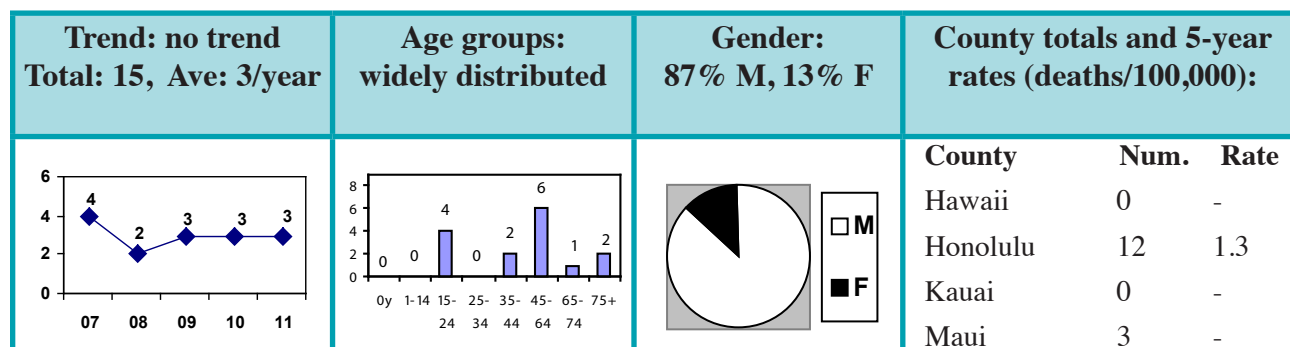
Hawaii Trauma Registry (toxicology data)

Only 16% of the injured pedestrians in the HTR had been drinking at the time they were hit. This percentage was significantly higher among those under 65 years of age (22%), as only 2% (3) of the 138 senior-aged pedestrians tested positive for alcohol. Illicit drug usage was documented for 25% of the patients, including 30% of those who were under 65 years of age. Alcohol use was nearly 8 times likely among pedestrians hit during night time hours (41%) than among those hit between 6:30 a.m. and 7:29 p.m. (5%).

Motor vehicle crashes, bicyclists

Fatal injuries

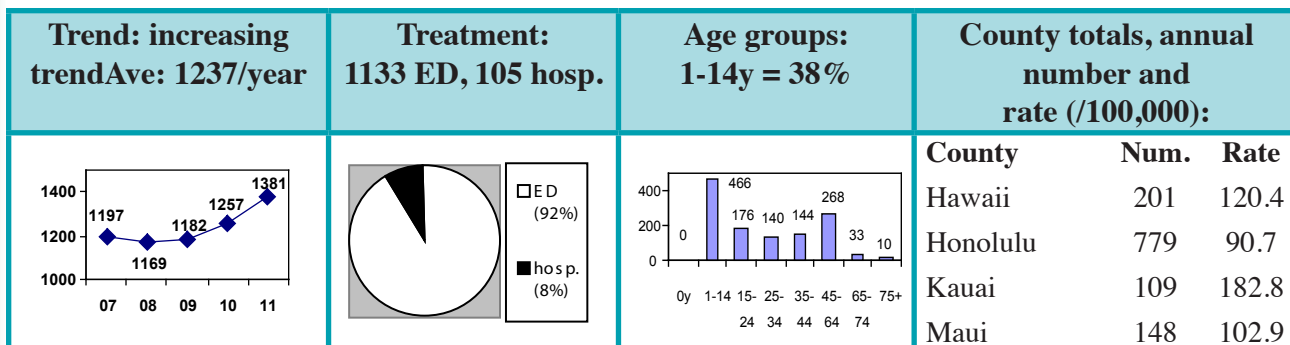
There were between 2 and 4 bicyclists killed in Hawaii each year, and 80% (12) of the 15 deaths occurred on Oahu. There was no apparent high-risk age group. Almost all (87%, or 13) of the bicyclists killed over the 5-year period were males. Most (87%, or 13) of the victims were hit by a car; 2 others died after falling off their bicycles. Only 2 of the victims were wearing helmets at the time of the crash (status unknown for 2 others). There was no notable peak time of the day for the crashes; most (64%, or 9) occurred between during daylight hours between 7:31 a.m. and 7:00 p.m.



Almost all (91%, or 10) of the 11 traffic-related crashes (from 2007 to 2010) involved cars traveling straight on the road; only 1 crash was due to a car making a turn. Two (18%) of the 11 bicyclists tested positive for alcohol, and 4 (36%) tested positive for drugs. Overall, about half (54%, or 6) of the victims tested positive for either alcohol or drugs. Besides substance use 2 bicyclists were traveling against traffic at the time of the crash and another failed to yield the right-of-way. Four (36%) of the 11 drivers made an error which contributed to the crash, most commonly substance use and speeding (2 instances each).

Nonfatal injuries

There were more than 1200 nonfatal injuries to bicyclists each year, with a generally increasing trend. Most (92%) of the injuries were treated in EDs. Males comprised 75% of the patients, including 80% of those who were hospitalized. Nearly one-third (31%) of the patients were 5 to 14 years of age, and the injury rate for 5 to 14 year-olds (244 injuries/100,000 residents) were more than 3 times higher than the rate for residents of other ages (74/100,000).



The injury rate for Kauai County residents was significantly higher than the rates for any other county, and approximately double the rate estimates for residents of Honolulu or Maui counties. Almost all (85%) of the injuries were coded as “non-traffic”, or occurring on private roads, driveways, or off-road environments. Most of the injuries treated in EDs (88%) and requiring hospitalization (71%) were coded to indicate crashes that did not involve a collision with another vehicle or object, but were probably due to the patient falling off of the bicycle. Although 92% of the patients were treated in EDs, hospitalizations comprised 32% of the treatment days and 66% of the total medical charges of \$5.8 million/year. Most (63%) of the hospitalized patients had fractures, including 15% with skull fractures and 20% with leg fractures. More than one-third (38%) of these patients had a traumatic brain injury.

EMS data and 2007 linked data (EMS, DOT, HHIC, FARS, death certificates)

Most (73%) of the EMS-attended bicyclist crashes were distributed over the 11-hour period of 7:31 a.m. to 6:29 p.m., with a peak from 4:31 p.m. to 6:29 p.m. (17%). About half (53%) of the injuries involved motor vehicles and 47% did not. Only 27% of the injured bicyclists wore helmets. Unhelmeted riders had a significantly higher proportion of “critical” or fatal injuries (2.1%, or 22 of 1031), compared to helmeted riders (0.7%, or 3 of 458). These differences were accentuated among crashes that involved motor vehicles, as the proportion of unhelmeted bicyclists with critical or fatal injuries was 3.1% (17 of 540), compared to 0.9% (2 of 214) among helmeted riders. Probable alcohol use was noted for about 9% of the patients. If only the bicyclists with known alcohol and helmet status were considered, helmet use was 5 times higher among those who did not consume alcohol (35%), compared to the drinkers (5%).

Linked data from 2007 showed odds of sustaining an injury that required hospitalization or resulted in death were 80% higher among unhelmeted rides compared to helmeted riders, although this estimate was only of “borderline” statistical significance ($p=0.11$).

Hawaii Trauma Registry (toxicology data)

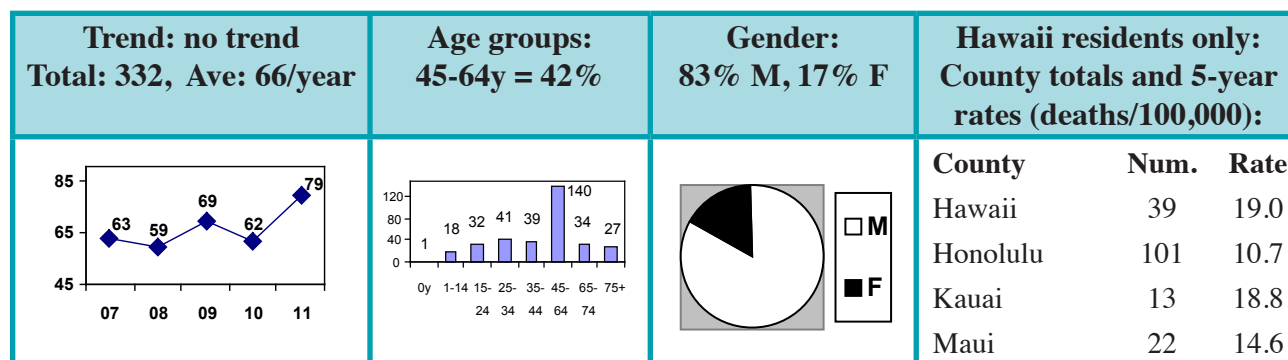
Only 11% of the injured bicyclists in the HTR had been drinking at the time they were injured. This percentage was nearly three times higher among those hurt in crashes that did not involve a motor vehicle compared to those who were hit by motor vehicles (15% vs. 6%, respectively). About one-quarter of the bicyclists tested positive for illicit drugs, most commonly narcotics (17%), and this proportion did not differ by the type of crash. Overall, one-third (33%, or 89) of the 271 patients tested positive for either alcohol or drugs. None of the 28 bicyclists who had been drinking were wearing a helmet at the time of the crash, compared to 27% usage among those who tested negative for alcohol, and 31% among those who were not tested.

Drownings (residents and non-residents)

Fatal injuries

There was no clear trend in the annual number of drownings, although the 79 deaths in 2011 was the highest total since at least 1993. Most of the high total in 2011 was due to drownings on Honolulu and Maui counties. About half (53%) of the victims were Hawaii residents, 36% from the U.S. mainland, and 12% from foreign countries. The ages of

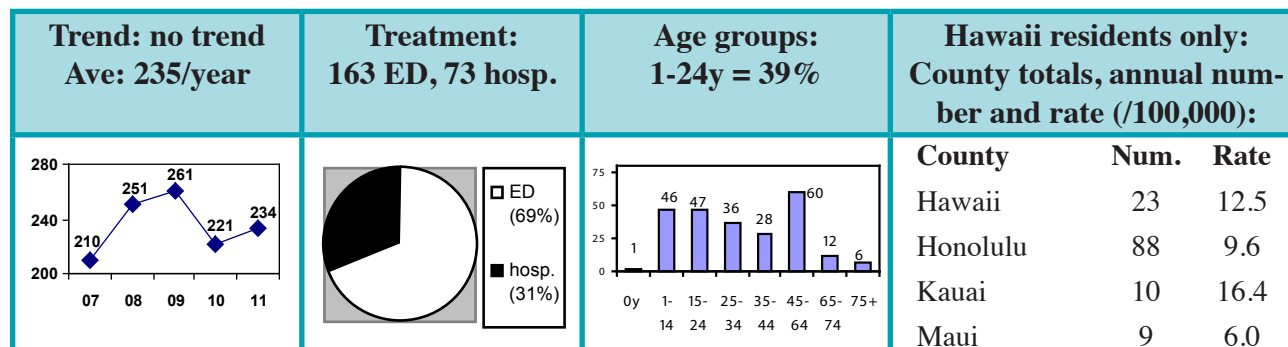
the victims were widely distributed, although only 8% were under 18 years of age. Almost all (83%) were males. About half (47%) of all the victims drowned on Oahu. If only drownings among Hawaii residents were considered, Oahu residents had the lowest rates, significantly lower than rates for Neighbor Island residents as a whole. If non-residents are also included, the highest (unadjusted) rate was computed for Kauai, approximately twice as high as rates for Hawaii County and more than 3 times the rates for Honolulu County.



Most (78%, or 259) of the victims drowned in the ocean or saltwater environments, almost all of whom (96%) were 18 years or older. Unintentional immersions led to 13% of these drownings, including 31 victims who fell in or were swept into the ocean. Other common activities were swimming (29% of victims), snorkeling (22%), and free diving (9%). According to autopsy records, intrinsic or personal factors contributed to over half (61%) of the saltwater drownings in Honolulu County from 2007 to 2010. The most common intrinsic factor was circulatory diseases, present among 46% of the victims of all ages, and 69% of those aged 50 years and older. Only 13% of the victims tested positive for alcohol, and only 7% had BAC levels of 0.08% or greater. Illicit drug use was considered a contribution to 12% of the drownings. Apart from ocean drownings, there were 36 drownings in swimming pools, 21 in rivers and streams, and 12 in bathtubs. Only 3 (8%) of the 36 victims who drowned in swimming pools were under 5 years of age, as victim age was widely distributed in this environment.

Nonfatal injuries (near drownings)

There was no clear trend in the annual number of near drownings, which averaged 235 per year. Hawaii residents comprised a slight majority (55%) of all patients treated for near drownings, but only 41% of those who were hospitalized. ED patients were significantly younger on average than those who were hospitalized (31 vs. 40 years of age), with more than half (56%) in the 15 to 44 year age group. Among Hawaii residents, county-specific rate estimates were generally comparable except for Hawaii and Maui county residents.



Hospitalizations were of a relatively short number of days (4.1, on average), but because each hospitalization incurred over \$28,000 in charges, they comprised most (91%) of the total \$2.3 million in annual medical charges in the state. Swimming (40%) and “surfing, windsurfing and boogie boarding” (32%) were the most common activities for the patients overall, although swimming was a more likely cause among non-residents (45%), while the latter activities were more common among residents (39%).

EMS data

Almost all (94%) of the incidents EMS responded to occurred during day time hours, including 80% between 9:31 a.m. and 5:29 p.m. More than half (59%) of the patients were Hawaii residents. About 43% of the near drownings occurred in bodies of water, which could include both freshwater and saltwater environments. About one-third (30%) were in patient residences (10%), public buildings (12%), hotels (5%), and health care facilities (3%). Most (77%) of the patients were either transported in “serious” (46%) or “critical” (32%) condition, with no significant differences in the distribution of patient condition between residents and non-residents. Probable alcohol use was noted for only 4% of the patients. Near drownings that occurred during night time hours were significantly more likely to involve alcohol consumption than day time incidents, however (21% vs. 3%).

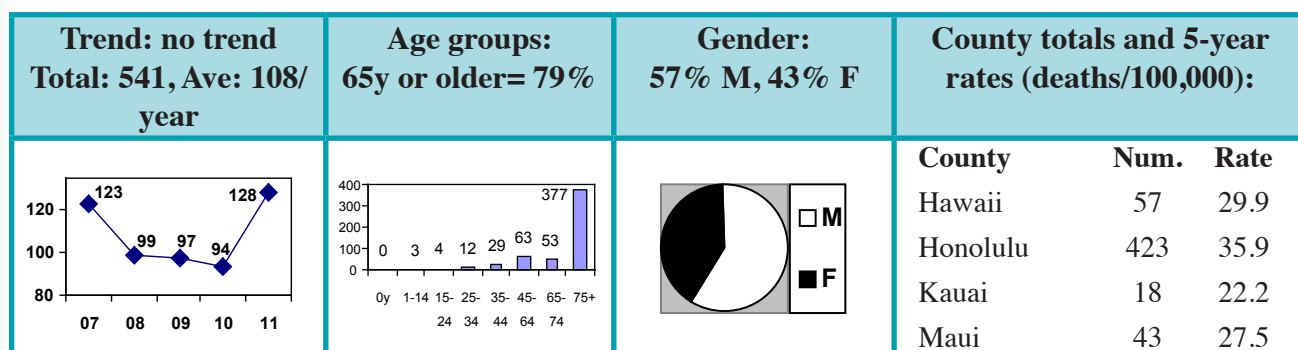
Hawaii Trauma Registry (toxicology data)

Only 8% of the adult-aged (18 years and older) HTR near drowning patients were positive for alcohol, and only 9% tested positive for illicit drugs, although there was no toxicological testing for about two-thirds of the patients. Substance use was somewhat higher among resident patients, although this comparison is limited by the small sample sizes and the lack of testing.

Falls

Fatal injuries

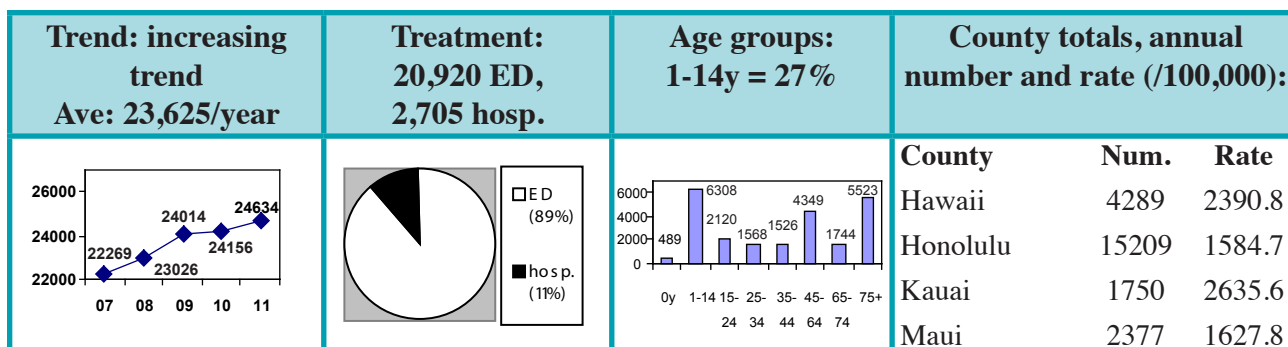
Falls were the most common type of fatal unintentional injury in the state, with the 541 deaths accounting for 25% of the total. More than three-quarters (79%) of the victims were aged 65 years or older, and the risk of fatal falls increased dramatically across the senior age range. Males comprised the majority (78%) of victims under 65 years of age, while gender was more equally distributed for the senior-aged victims. Honolulu County residents comprised most of the victims of all ages (77%) and those who were 65 years or older (81%). The fall fatality rate estimate for senior-aged residents of Honolulu County was significantly higher than the rates for residents of Kauai or Maui counties, and 45% higher than for Neighbor Island residents considered as a whole.



Death certificates provided little information on the causes of falls, as most were coded as “falls on the same level” with no further description (48%), or “unspecified” causes (32%). Falls from stairs or steps were the most specifically coded cause, but comprised only 4% of the total. More than half (61%) of the falls occurred at the residence of the victim, including 68% of the senior-aged victims.

Nonfatal injuries

Falls were the leading cause of nonfatal injuries among Hawaii residents, with nearly 21,000 ED visits and over 2,700 hospitalizations each year. The annual number of injuries generally increased. Children aged 1 to 14 years comprised 27% of all patients, but about two-thirds (68%) of those who were hospitalized were 65 years or older. Gender was equally distributed among patients treated in EDs, but females comprised 59% of the patients that were hospitalized.



Residents of Hawaii and Kauai counties had significantly higher rates of nonfatal injuries from falls than residents of Honolulu and Maui counties. The residents of Honolulu County had the lowest rates of hospitalizations. Among the more specifically coded injuries, the most common causes were falls from stairs, steps and escalators (5.3% of the total), beds (3.7%), skateboards (3.5%), and chairs, playground equipment, and ladders (about 2% for each). At least half (53%) of the falls that caused hospitalizations in seniors occurred in home environments. This proportion increases to 84% if only records with specific information on location are considered. The most common activity related to the falls was “walking, marching and hiking”, accounting for 30% of the total. Skateboarding, running, tackle football, and bathing and showering were also prominent activities. Hospitalizations averaged nearly 1 week in duration, resulted in over \$31,000 in medical charges, and accounted for 72% (\$84 million) of the total annual charges of \$116.6 million. Fractures were present in nearly three-fourths (74%) of the hospitalized patients, including 29% with hip fractures. Additional data is presented for nonfatal falls specifically among senior-aged residents.

EMS data

More than half (57%) of the EMS-attended falls occurred in the home or residence of the patient, and this proportion was significantly higher among the seniors (71%) compared to younger aged patients (41%). More than half (54%) of the patients were 65 years or older, including 22% who were 85 years or older. Senior-aged patients had worse dispositions, as they were more likely to be transported in serious condition (49%, compared to 40% of younger age patients) and less likely to be released at the scene (12% vs 19%, respectively). Probable alcohol use was noted 8% of the patients, and male patients were more than twice as likely to have used alcohol compared to females (12% vs. 5%).

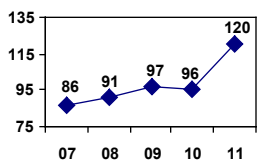
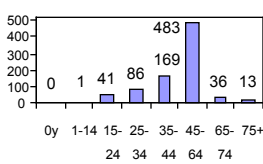
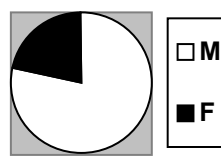
Hawaii Trauma Registry (toxicology data)

Only 11% of the adult-aged (18 years and older) HTR resident patients who were injured by falls were positive for alcohol, with 4 times higher use among patients in the 18 to 64 year age group (19%), compared to senior-aged patients (5%). Fifteen percent of the patients tested positive for illicit drugs, most commonly narcotics (11%). Considered together, about one-quarter (24%, or 587) of the patients tested positive for either alcohol or drugs, although that proportion was much lower among the senior-aged patients (13%), compared to younger patients (36%).

Poisonings

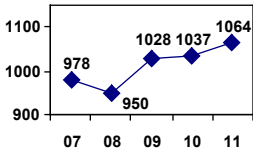
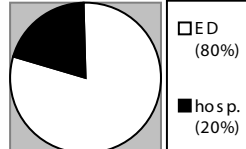
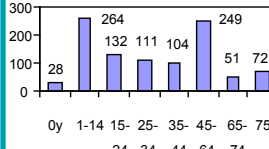
Fatal injuries

There was an increasing trend in the annual number of unintentional poisonings. (There was no consistent trend in the number of poisonings of undetermined intent over this period.) Victim age was narrowly distributed, as 58% were in the 45 to 64 year age range. Males comprised 78% of the victims. Most (82%) of the victims were poisoned on Oahu, and the highest fatality rates were computed for Honolulu County residents. Inclusion of poisonings of undetermined intent resulted in significantly lower rates among Oahu residents compared to Hawaii or Maui county residents, so these comparisons are unreliable. Drugs caused almost all (93%) of the poisonings, including 32% from “narcotics and hallucinogens” and 34% from “sedative-hypnotic and psychotropic drugs”.

Trend: increasing trend Total: 490, Ave: 98/year	Age groups: 45 to 64= 58%	Gender: 78% M, 22% F	County totals and 5-year rates (deaths/100,000):		
			County	Num.	Rate
			Hawaii	37	21.8
			Honolulu	400	43.4
			Kauai	16	22.3
			Maui	37	24.4

Nonfatal injuries

There was an increasing trend in the number of nonfatal poisonings, but this was evident only for ED visits among Honolulu and Maui county residents. Gender was nearly equally distributed with 53% male patients. Patient age was broadly distributed, although one-quarter (26%) were 1 to 14 years of age. Seniors comprised only 13% of all patients, but (23%) of those who were hospitalized. Rates of ED visits were highest by far for residents under 5 years of age, nearly 5 times higher than the rate for all other age groups. Residents of Honolulu and Maui counties had comparable injury rates, significantly lower than the rates for residents of Hawaii and Kauai counties.

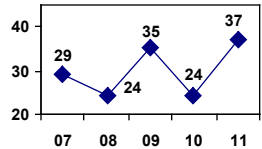
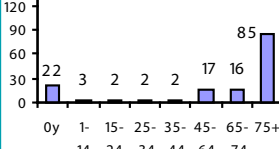

Trend: increasing trend Ave: 1011/year	Treatment: 805 ED, 207 hosp.	Age groups: 1-14y = 26%	County totals, annual number and rate (/100,000):															
			<table><tr><th>County</th><th>Num.</th><th>Rate</th></tr><tr><td>Hawaii</td><td>193</td><td>109.7</td></tr><tr><td>Honolulu</td><td>643</td><td>69.4</td></tr><tr><td>Kauai</td><td>72</td><td>112.6</td></tr><tr><td>Maui</td><td>103</td><td>69.5</td></tr></table>	County	Num.	Rate	Hawaii	193	109.7	Honolulu	643	69.4	Kauai	72	112.6	Maui	103	69.5
County	Num.	Rate																
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Maui	103	69.5																

Patients were hospitalized for slightly over 3 days on average, with nearly \$18,000 in medical charges. Most (76%) of the poisonings were caused by drugs or medicinal substances, including 92% of those that required hospitalization. Narcotics caused 21% of the hospitalizations, tranquilizers 13%, aromatic analgesics (which include acetaminophen, or Tylenol) 8%, and cardiovascular agents 8%.

Suffocations

Fatal injuries

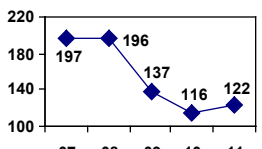
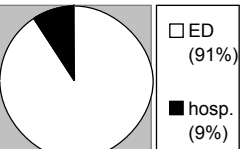
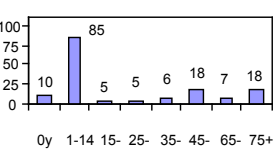
The annual number of suffocations varied inconsistently between 24 and 37 deaths. The age distribution was bimodal, as most (68%) victims were 75 years or older, but there were also 24 victims (16%) who were under 4 years of age. Twenty-two of the victims were infants, all but 3 of whom suffocated in their beds or sleeping environments. Most (89%) of the victims suffocated on Oahu, including 92% of those who were 65 years and older. The most commonly specified causes were inhalation of food (19% of suffocations) or gastric contents (2%). Most (58%) were coded as inhalation of "other objects" with little further detail available. Including deaths from SIDS and "unspecified causes of mortality" as well as infant suffocations, there was an average of 15 infant deaths a year that were sleep-related or possibly sleep-related, with no trend in the annual number.

Trend: no trend Total: 149, Ave: 30/year	Age groups: 65y or older= 68%	Gender: 67% M, 33% F	County totals and 5-year rates* (deaths/100,000):															
			<table><tr><th>County</th><th>Num.</th><th>Rate</th></tr><tr><td>Hawaii</td><td>10</td><td>-</td></tr><tr><td>Honolulu</td><td>132</td><td>91.2</td></tr><tr><td>Kauai</td><td>2</td><td>-</td></tr><tr><td>Maui</td><td>5</td><td>-</td></tr></table>	County	Num.	Rate	Hawaii	10	-	Honolulu	132	91.2	Kauai	2	-	Maui	5	-
County	Num.	Rate																
Hawaii	10	-																
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Kauai	2	-																
Maui	5	-																

*Includes only residents aged 65 years and older.

Nonfatal injuries

There was a decreasing trend in the overall number of nonfatal suffocations in the state, due mostly to decreases in ED visits over the 2008-2010 period. More than half (53%) of the patients were under 5 years of age. Senior-aged residents comprised 58% of the patients who were hospitalized. Males comprised a slight majority (53%) of the patients. Oahu residents comprised 59% of the patients, but rates of ED visits for nonfatal suffocations were significantly higher among residents of Neighbor Islands (14 visits per year/100,000 residents) compared to Oahu residents (9 visits/100,000).

Trend: decreasing trend Ave: 154/year	Treatment: 152 ED, 16 hosp.	Age groups: 0-14y = 62%	County totals, annual number and rate (/100,000):															
			<table><tr><th>County</th><th>Num.</th><th>Rate</th></tr><tr><td>Hawaii</td><td>18</td><td>10.8</td></tr><tr><td>Honolulu</td><td>92</td><td>9.9</td></tr><tr><td>Kauai</td><td>10</td><td>-</td></tr><tr><td>Maui</td><td>33</td><td>21.1</td></tr></table>	County	Num.	Rate	Hawaii	18	10.8	Honolulu	92	9.9	Kauai	10	-	Maui	33	21.1
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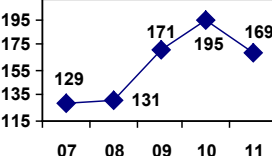
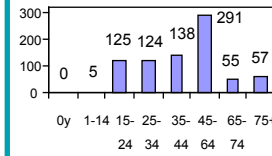
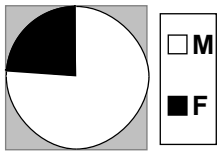
More than half (61%) of the hospitalizations were caused by the inhalation of food and somewhat less commonly (33%) by the inhalation of other (non-food) objects. Non-food objects caused 61% of the ED visits for nonfatal suffocations, while inhalation of foods caused 38%. Almost all (97%) the suffocations were diagnosed as "foreign body entering through orifice".

Intentional injuries

Suicides and suicide attempts

Fatal injuries

There was a generally increasing trend in the number of suicides in the state, and the 195 deaths in 2010 was by far the highest total in the 21-year period (1991 to 2011) for which data was available. Victim age was widely distributed, although almost all (95%) were 19 years or older. The highest fatality rates were computed for residents aged 45 to 54 years and those 85 years and older. Male victims outnumbered females by approximately 3-to-1. More than half (58%) of the victims were residents of Oahu, but the fatality rate for Oahu (58/100,000 residents) was significantly lower than the rate for the combined Neighbor Islands (94/100,000).

Trend: increasing Total: 795, Ave: 159/year	Age groups: 20 to 60y= 74%	Gender: 76% M, 24% F	County totals and 5-year rates (deaths/100,000):		
			County	Num.	Rate
			Hawaii	150	98.6
			Honolulu	465	57.5
			Kauai	50	85.5
			Maui	130	94.9

The most common mechanism was by hanging or suffocation (49% of the suicides), followed by firearm use (20%). Most (65%) of the Oahu victims had a documented history of mental illness (as variously defined), according to autopsy records from 2007 to 2010. The most common negative life events for the victims were related to intimate relationship problems (34%), usually a break-up or divorce (12%), or serious illness or medical issues (26%). The latter was documented for 60% of the senior-aged victims. Over one-third (37%) had a history of substance abuse, 19% had a BAC level over 0.08%, and 34% tested positive for illicit drugs. Nearly one-third (32%) of the victims had a previous suicide attempt documented in the record, and more than half (56%) had verbally threatened suicide.

Nonfatal injuries

There was an increasing trend in the number of nonfatal suicide attempts, which was only evident in the annual number of injuries that were treated in EDs. Slightly more than half (56%) of the injuries were treated in EDs, unlike most types of injuries. Most (58%) of the patients were under 35 years of age, and residents aged 15 to 19 years had the highest rates of hospitalizations and especially ED visits. The gender distribution of patients was similar for both settings, with females comprising 57% of the total.

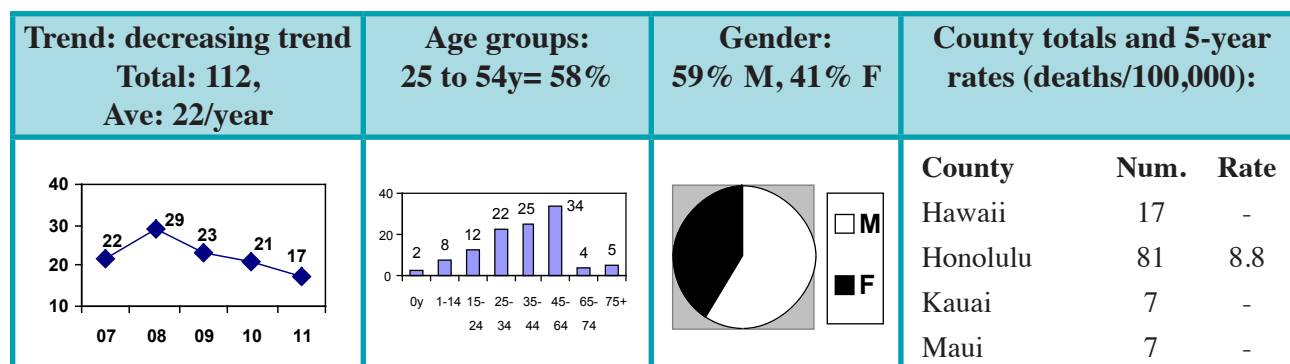
Trend: increasing trend Ave: 826/year	Treatment: 465 ED, 361 hosp.	Age groups: 15-24y = 33%	County totals, annual number and rate (/100,000):																																																						
<table border="1"><caption>Nonfatal Injuries by Year</caption><thead><tr><th>Year</th><th>Count</th></tr></thead><tbody><tr><td>07</td><td>776</td></tr><tr><td>08</td><td>781</td></tr><tr><td>09</td><td>840</td></tr><tr><td>10</td><td>825</td></tr><tr><td>11</td><td>908</td></tr></tbody></table>	Year	Count	07	776	08	781	09	840	10	825	11	908	<table border="1"><caption>Treatment Distribution</caption><thead><tr><th>Treatment</th><th>Count</th><th>Percentage</th></tr></thead><tbody><tr><td>ED</td><td>465</td><td>56%</td></tr><tr><td>hosp.</td><td>361</td><td>44%</td></tr></tbody></table>	Treatment	Count	Percentage	ED	465	56%	hosp.	361	44%	<table border="1"><caption>Nonfatal Injuries by Age Group</caption><thead><tr><th>Age Group</th><th>Count</th></tr></thead><tbody><tr><td>0y</td><td>0</td></tr><tr><td>1-14</td><td>42</td></tr><tr><td>15-24</td><td>425</td></tr><tr><td>25-34</td><td>284</td></tr><tr><td>35-44</td><td>195</td></tr><tr><td>45-64</td><td>297</td></tr><tr><td>65-74</td><td>27</td></tr><tr><td>75+</td><td>18</td></tr></tbody></table>	Age Group	Count	0y	0	1-14	42	15-24	425	25-34	284	35-44	195	45-64	297	65-74	27	75+	18	<table><tr><th>County</th><th>Num.</th><th>Rate</th></tr><tr><td>Hawaii</td><td>166</td><td>98.8</td></tr><tr><td>Honolulu</td><td>525</td><td>58.1</td></tr><tr><td>Kauai</td><td>61</td><td>102.3</td></tr><tr><td>Maui</td><td>74</td><td>51.5</td></tr></table>	County	Num.	Rate	Hawaii	166	98.8	Honolulu	525	58.1	Kauai	61	102.3	Maui	74	51.5
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Residents of Kauai and Hawaii counties had significantly higher rates of nonfatal self-inflicted injuries compared to residents of Honolulu and Maui counties. Over half (58%) of the ED visits and most (85%) of the hospitalizations were caused by poisonings from drugs or medicinal substances, most commonly from the “analgesics, antipyretics, and antirheumatics” class (22% of ED visits, 33% of hospitalizations), which includes both narcotics (heroin, and other opiates), as well as aspirin and acetaminophen. Female patients were more likely to attempt by drug or medicinal poisonings (76%, vs. 62% for male patients).

Homicides and assaults

Fatal injuries

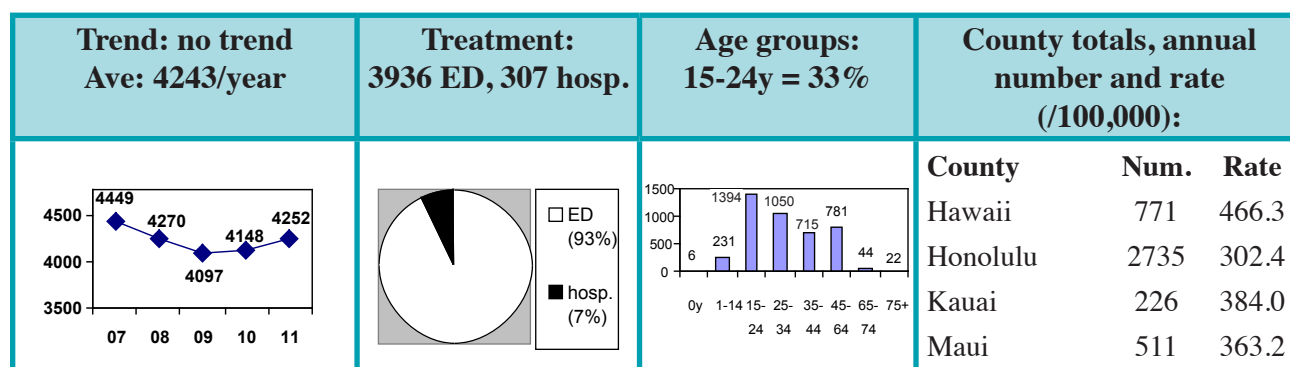
There were 112 victims of homicide over the 5-year period, with a significantly decreasing trend from 29 in 2008 to 17 in 2011. More than half (58%) of the victims were in the 25 to 54 year age range, but there were also 6 victims (5%) who were under 5 years of age. Males comprised 59% of the victims. The fatality rate for residents of Oahu (8.8 deaths/100,000 residents) was statistically comparable to the rate for all Neighbor Island residents (8.4/100,000).



The most common method was the use of firearms (35%), followed by stabbings (28%), and physical force or unarmed beatings (25%). According to Uniform Crime Reports from 2007 to 2009, most (73%) of the homicide victims knew their assailant, and only a minority (19%) were killed by strangers. Female victims were most likely to be killed by their intimate partner (37%, vs. 5% of male victims), while males were most likely to be killed by extra-familial acquaintances (40%) or strangers (25%).

Nonfatal injuries

There were over 4200 nonfatal injuries from assaults among Hawaii residents each year, with no clear trend over time. Males comprised two-thirds (67%) of the patients treated in EDs and an even greater proportion (89%) of those who were hospitalized. More than half (58%) of the patients were 15 to 34 years of age; few (5%) were under 15 years of age, or over 65 years of age (1%). The peak age for rates of both ED visits and hospitalizations was the 15 to 29 year age group, particularly 20 to 24 year-olds.



The injury rate for residents of Hawaii County was significantly higher than for any other county, while the rate for residents of Honolulu County was significantly lower than any other county. Patients were hospitalized for nearly 5 days on average, with over \$31,000 in charges for each admission. Unarmed beatings caused 70% of all injuries, and 61% of those that required hospitalization. Fractures were the most common type of injury (53%) that required hospitalization, including 44% of patients admitted with a skull fracture.

EMS data

The number of EMS-attended incidents generally increased over the course of the day (starting at 6 a.m.), reaching a broad peak during the 7:31 p.m. to 2:29 a.m. period (48% of the total). The home or residence of the patient was the most common location for the assault (40%), followed by other indoor location or buildings (17%), most commonly “public buildings” (7%), and bars and restaurants (6%). One-fifth (20%) of the patients were transported in serious or critical condition. That proportion was highest among the senior-aged victims (29%). Probable alcohol use was noted for 29% of the patients. Patients who had consumed alcohol were significantly less likely to be released at the scene (34%, vs. 52% for other patients), and twice as likely to be transported in serious condition (31% vs. 15%, respectively).

Hawaii Trauma Registry (toxicology data)

Nearly half (46%) of the adult-aged (18 years and older) HTR resident patients who were injured by assaults were positive for alcohol, and more than one-third (38%) tested positive for illicit drugs. About three-fourths (76%, or 286) of the 375 drinkers had BAC levels of 0.08% or greater. THC was the most commonly documented drug (19% of the patients), followed by amphetamines (15%) and narcotics (15%). Considered together, about two-thirds (67%) of the patients tested positive for either alcohol or drugs. Alcohol use was significantly more likely among the male patients (49%) compared to females (27%), among those injured on weekends (54% vs. 41% for those assaulted on weekdays), and among those assaulted during night time hours (54%, vs. 30% for those injured between 6:31 a.m. and 7:29 p.m.).

Data Sources and Methodology

The primary source of injury mortality data in Hawaii is the death certificate database of the Hawaii Department of Health. The ICD-10 underlying cause of death codes were grouped as recommended by the Centers for Disease Control and Prevention, with some exceptions.¹ For some types of injuries, the open text information on how the injury occurred was reviewed to extract information not captured by the cause of death code. Supplemental data was also used for certain injury categories. Data from the Fatal Analysis Reporting System² (FARS) of the National Highway Traffic Safety Administration (NHTSA) was linked to death certificate data for deaths from traffic crashes. Supplemental data on homicides was abstracted from the Uniform Crime Reports (UCR), maintained by the National Archive of Criminal Justice data.³ The autopsy records of Oahu suicide and drowning victims were also reviewed for the 2007 to 2010 period.

Fatal injuries are described within the main intent categories of unintentional injuries (drownings, car crashes, etc.) and intentional injuries (homicides and suicides), as defined by the CDC recommended framework.¹ Unintentional injuries are described both as a total and separately within the 8 main mechanisms: motor vehicle crashes involving occupants, motorcyclists, pedestrians, and bicyclists, and falls, drownings, poisonings, and suffocations. The intent of the fatal injury could not be determined for some injuries, and these are described as a total in one of the final chapters.

One section of this document compares general injury mortality in Hawaii versus that in the rest of the United States. The national data comes from the WISQARS⁴ (Web-based Injury Statistics Query and Reporting System) online database, accessed at the web site for the Centers for Disease Control and Prevention. The fatality totals from this database were adjusted for the portion of deaths among Hawaii residents. WISQARS mortality data beyond 2009 was not available. The period of 2005 to 2009 was chosen in order to allow for 5-year comparisons of injury mortality between Hawaii and the rest of the United States. FARS data was used to compare Hawaii fatality rates from traffic crashes versus the rest of the U.S., since the WISQARS data contains a high proportion of records coded as “other” or “unspecified” for victims killed in traffic crashes. FARS data is more specific in this regard, i.e. able to distinguish automobile occupants from motorcyclists from pedestrians. State comparisons with the FARS data covered the 4-year period from 2007 to 2010.

The calculation of injury mortality rates necessitates the definition of “at risk” populations for the denominator. For the section comparing U.S. and Hawaii fatality rates, the denominator was the average annual resident population over the 2005 to 2009 period. This data was obtained from the web site for the U.S. Census Bureau.⁵ Other analyses compared rate estimates of the 4 counties within Hawaii, using the average annual population estimate over the 2007 to 2010, since 2011 estimates were not available when preparation of this report began. Some injury rates were computed and compared for specific ethnicities. Ethnicity was assigned using the first-listed ethnicity on the death certificate. Ethnic-specific rates were computed using resident population estimates from the 2010 U.S. Census.⁶ The “alone or in any combination” enumerations were used for all ethnicities. The results of these analyses were not substantially different when the “alone” enumerations were used, except for Hawaiians. Since there were too few deaths within some of the ethnicities to adjust the rates for age distribution, comparisons were made using “crude” or unadjusted rate estimates. For these reasons, the results from these ethnic-specific comparisons should be interpreted with caution. For motor vehicle crashes, the 2009 National Household Travel Survey provided an alternative to population estimates as a measure of exposure. NHTS included estimates of the number of person trips taken by different modes of transportation, for over 7,100 Hawaii residents.⁷

This report includes mostly information on injuries among residents of Hawaii. This is consistent with national reporting conventions of injury mortality and allows for the comparison of fatal and nonfatal injury rates in Hawaii with rates for the remainder of the country. Since age and county-specific population estimates are also available only for residents, the inclusion of injuries among non-residents would result in a slight overestimation of mortality and morbidity rates. There were 339 total injury-related deaths of non-residents over the 5-year period, or about 9% of the total. As this is a considerable number of deaths, there is a separate section of the document which examines these deaths (and nonfatal injuries) in more detail. In general, however, exclusion of deaths among non-residents does not significantly impact the description of the remaining fatal injuries in this document. Residents represented at least 92% of the victims in the major injury categories, with the exception of drownings, 53% of which occurred among non-residents. There is therefore a separate section on drowning which includes information on both resident and non-resident victims.

Also excluded from this report were 42 deaths that were due to “adverse effects” of medical treatment; injuries resulting from surgical or medical care, or adverse reactions to drugs or medicinal substances. These iatrogenic events generally occur outside of the usual public health context of injury prevention.

The source of data on nonfatal injuries was the Hawaii Health Information Corporation (HHIC), which receives abstracted data from the medical records of patients treated in all hospital-based emergency departments (EDs) and hospitals in the state, with the exception of ED records from Tripler Army Medical Center. A record was defined as injury-related if the principle diagnosis was within the ICD-9CM series 800-995.85, with the following exclusions: 909.3, 909.5, 995.0-995.4, 995.6-995.7.⁸ Patients who died in the hospitals or who were discharged to hospice facilities were excluded from these analyses. To prevent double-counting of injuries, patients who were transferred to another hospital at discharge were excluded. Injuries resulting from “adverse effects”, as indicated by external cause of injury codes (E-codes),⁹ were also excluded. E-codes were used to group nonfatal injuries into mechanisms that corresponded to the groupings for fatal injuries.⁹ In this report, all nonfatal self-inflicted injuries are described as “suicide attempts”, although this is not actually discernible through E-codes. This may have resulted in an overestimation of suicide attempts, but it is also possible that self-inflicted injuries in general are underreported.

It is important to note that the extent of E-coding varied across the counties patients reside in, and over time within those counties (Table 1). The records for residents of Neighbor Islands were significantly more likely to have E-codes than records for residents of Honolulu County (on average 97.4% vs. 87.5%, respectively). There were also decreasing trends in the proportion of inpatient records with E-codes for all counties except Maui, although these were most meaningful for Oahu hospitals. Closer examination indicated most of the decrease in E-coding at Oahu hospitals was due to 3 of the 12 facilities that contribute to the HHIC database. These variations in E-coding need to be considered when interpreting comparisons between counties and examining trends within a county over time. Most statistics in this report are based only on E-coded records, and therefore underestimate the real magnitude of injuries by about 9% for both those treated at EDs and for those injuries requiring hospitalizations.

E-coding also varied slightly by age of patient and the treatment setting. E-coding was most complete for ED records for infants (93.3%), and progressively decreased to 90.4 among 25 to 34 year-old patients, before maintaining that level among older-aged patients. There was an opposite pattern for the inpatient records, with the lowest level of E-coding for infant patients (80.1%), but progressively increasing to 91.2% for records for 35 to 44 year-old and successively older patients. For all HHIC records considered together, the level of E-coding was highest for the records of infant patients (92.7%), followed by 1 to 14 year-old patients (92.2%), and varied between 90.2% and 91.0% for the records of older-aged patients.

There was some inconsistency in the contribution to the HHIC database from certain individual hospitals. One Oahu hospital began contributing ED records in November, 2008, although this hospital accounted for only 1.4% of ED records. Two other Oahu hospitals closed operations in mid-December of 2011.

EMS data is included in certain chapters (motor vehicle crashes, falls and assaults) for which there were discreet injury codes in the EMS data collection system. Data was available for all 4 county agencies over the 2007 to 2011 period, but there were some limitations related to a software change for parts of 2008 and 2009. For this reason, examination of trends is not possible with EMS data. EMS data, however, does document use of protective equipment (seat belts and helmets) and the approximate time and location of the injury, elements which are lacking from the more population-based HHIC data. Patient use of alcohol and drugs is also noted in EMS data, either by patient admission, the smell of alcohol on the breath, or physical evidence (e.g. bottles, drug paraphernalia, etc.) at the scene. However, since use of “drugs” is not specific, only the EMS characterization of patient alcohol use is examined. To avoid double-counting of individual patients, those who were transferred to another EMS unit were excluded from analyses. Patients who refused transport to hospitals (or released at the scene) and those who were dead upon EMS arrival or who died while in EMS care were included, however, to provide a full description of the effects of protective factors or alcohol use.

EMS data also includes the location of the incident, to the nearest census tract. This information was used to map the locations of injuries from motor vehicle crashes, bicycle crashes, drownings and near-drownings (including non-residents), and assaults. The resulting maps are not a complete capture of EMS-attended injuries, however, given the data lapse described above. Also, some injury cases were identified through supplementary fields (e.g. dispatch complaint), which were not uniformly present or utilized across all 4 county EMS agencies at all times. For these reasons, the most appropriate use of these maps is to compare the geographical frequencies of injuries within each county; the reliability of cross-county comparisons is uncertain.

A grant from the Hawaii Department of Transportation (DOT) enabled the linkage of 2007 EMS records related to motor vehicle crashes to DOT, HHIC, and FARS, and death certificate records. EMS records were linked to DOT, FARS and death certificate records probabilistically, on the basis of time, date, and location of the crash, and patient age, gender and seating position. This product was then linked to HHIC records by deterministic methods using patient identifiers, including name and date of birth. This linked dataset provided examination of the effect of protective devices (as described by EMS, DOT and FARS) with the ultimate medical disposition of the patients (as described by HHIC records and death certificates).

More complete and test-based results of toxicology were available from the Hawaii Trauma Registry. The HTR includes data from the 7 main trauma centers in the state. Data was available for the 2008 to 2011 period, but 6 of the trauma centers did not begin contributing data until 2009. The amount of toxicologic testing varied across facilities and within facilities over time, so it was not possible to compare results across counties or examine trends over time. HTR data was included to provide a description of substance use among patients who had nonfatal (although serious) injuries from a variety of mechanisms. To avoid double-counting, the results of HTR patients who were transferred at discharge were excluded. Patients who died, either in the ED or after hospitalization, were included, to examine associations between substance use and mortality for injuries where these relationships are not better described through other data systems (e.g. motor vehicle deaths and FARS).

Age-standardization was by the direct method, using the U.S. 2000 standard population.¹⁰ Sixteen age groups were used for standardization across all ages, although certain calculations were restricted to more narrow age ranges. Statistical tests were conducted with t-tests for continuously distributed variables (e.g. patient age) and chi-squared tests for categorical variables (e.g. patient gender).¹¹ Some trends (described as “significant” or “non-significant”) were formally assessed using Poisson regression.¹² Rate differences were tested using different techniques, depending on sample size and use of age standardization.¹³ All statistical significance testing was conducted at the 95% confidence level.

Table 1. Annual percentage of injury-related medical records with E-codes, by data source and county of residence of patient, 2007-2011.

County of residence	2007	2008	2009	2010	2011	5-year average
Emergency department records						
Hawaii	99.0	98.6	99.1	99.3	98.0	98.8
Honolulu	88.7	88.5	87.3	85.4	87.6	87.5
Kauai	96.4	95.8	96.8	95.7	93.8	95.7
Maui	94.4	97.7	97.3	97.3	97.4	96.8
state	91.7	91.8	91.1	89.7	90.8	91.0
Hospital admission records						
Hawaii	99.9	99.1	97.7	96.1	96.9	98.0
Honolulu	89.9	89.9	89.6	85.6	84.4	87.8
Kauai	98.0	98.3	97.4	95.4	93.7	96.8
Maui*	99.5	99.5	99.5	99.4	98.7	99.3
state	92.5	92.4	91.8	88.4	87.4	90.5
Total						
Hawaii	99.0	98.6	99.0	99.2	98.0	98.8
Honolulu	88.8	88.6	87.5	85.4	87.3	87.5
Kauai	96.4	95.9	96.8	95.6	93.8	95.7
Maui	94.8	97.9	97.4	97.4	97.5	97.0
state	91.8	91.8	91.1	89.6	90.6	91.0

*Indicates non-significant trend over the 2007-2011 period.

Overview of Injuries Among Hawaii Residents

Fatal injuries

There were 3,355 injury-related deaths among the residents of Hawaii over the 5-year period. This total represented 7.5% of the 47,245 total number of deaths that occurred among Hawaii residents during this period. Unintentional injuries were the fourth leading cause of death for residents of all ages, and the leading cause of death for those aged 1 to 40 years (Figure 1). In fact, injuries accounted for more deaths in this age group than all other causes combined. Suicides and injuries of undetermined intent were also prominent categories of overall mortality in this age range.

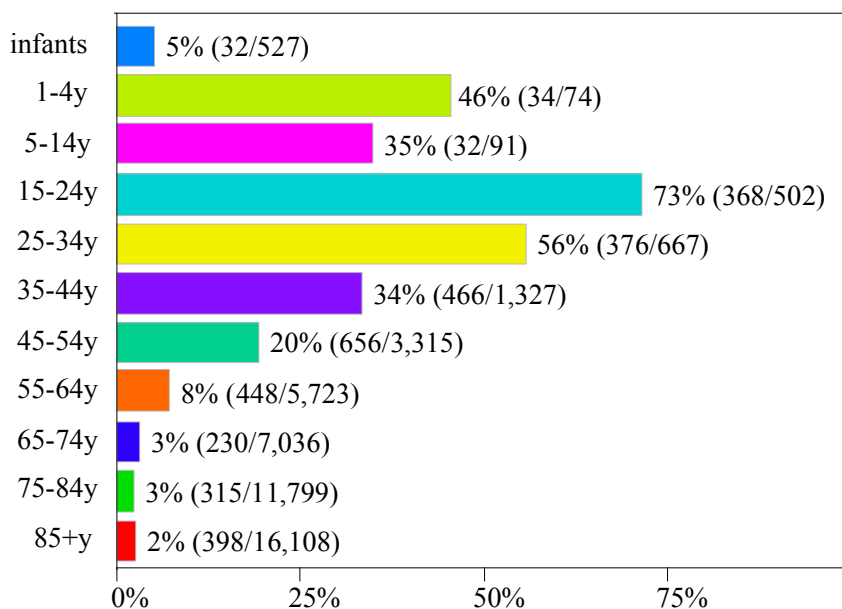
Figure 1. Five leading causes of death among Hawaii residents, by age group, 2007-2011.

Rank	infants (529)	1-9 y (116)	10-19 y (235)	20-29 y (629)	30-39 y (897)	40-64 y (9,859)	65+ y (34,976)	all ages (47,241)
1	perinatal conditions 292	unintent. injuries 38	unintent. injuries 87	unintent. injuries 244	unintent. injuries 208	cancer 3,161	heart diseases 8,911	heart diseases 11,171
2	congenital anomalies 70	cancer 17	suicide 51	suicide 143	cancer 141	heart diseases 2,079	cancer 7,531	cancer 10,936
3	unintent. injuries 27	congenital anomalies 8	cancer 29	cancer 55	suicide 133	unintent. injuries 756	CVD 2,589	CVD 3,112
4	respiratory disease 24	influenza/ pneumonia 11	congenital anomalies 10	heart diseases 46	heart diseases 119	CVD 480	CLRD* 1,276	unintent. injuries 2,159
5	septicemia 8	homicide 6	heart diseases 8	injuries of und. intent 33	injuries of und. intent 34	suicide 356	influenza/ pneumonia 1,183	CLRD* 1,483

*CLRD=chronic lower respiratory disease

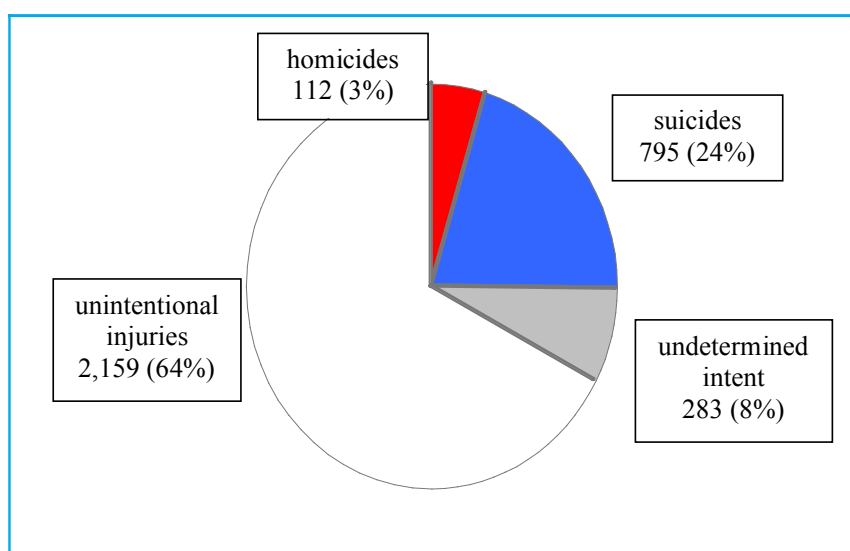
The importance of injuries as the leading cause of death among children and young adults is shown in Figure 2. Injuries accounted for 40% of all deaths among children aged 1 to 14 years, and almost three-fourths of those among decedents aged 15 to 24 years. Injuries also caused the majority of deaths among 25-34 year-olds, and one-third of those among 35-44 year-olds. Overall, almost half (48%) of all deaths among residents aged 1 to 44 years were injury related. Injuries were the leading cause of years of potential life lost before the age of 65 among state residents. Over the 5-year period, a total of 60,287 person years of life were lost before the age of 65 due to fatal injuries. In comparison, 36,820 years of life before age 65 were lost due to cancer, and 26,229 due to heart disease.

Figure 2. Injury deaths as a percent of all deaths among Hawaii residents, by age group, 2007-2011.



The majority (64%) of the 3,355 injury-related deaths were classified as unintentional (Figure 3). Suicides constituted 24% of the total, homicides 3%, and injuries of undetermined intent the remaining 8%. Each of these four categories of fatal injuries will be discussed in more detail in the following sections.

Figure 3. Fatal injuries among residents of Hawaii, by intent, 2007-2011.

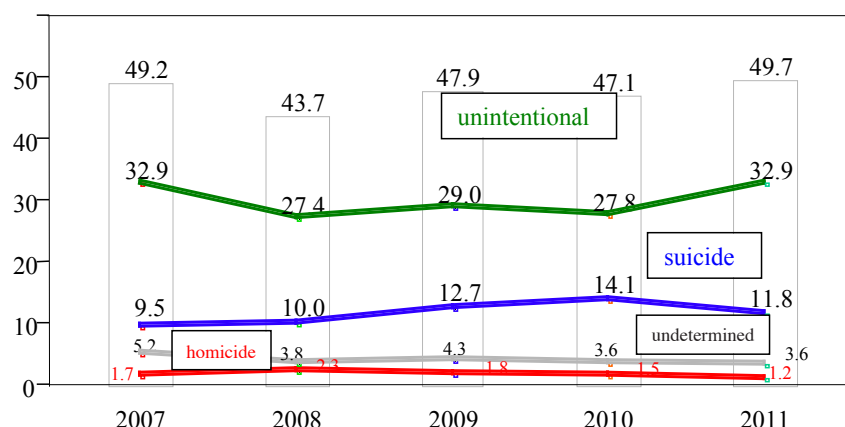


Not shown are 6 deaths that were due to legal intervention.

Annual rates of fatal injuries are shown by the main intent categories in Figure 4. There was no significant trend for the rate of all fatal injuries, although there was a significantly increasing trend in the rate of suicides. The fatality rate for suicides increased by 42% over the 5-year period, and by 93% over the 2007 to 2010 period. The fatality rate for unintentional injuries decreased significantly by 23% over the 2007 to 2010 period, but the subsequent increase in 2011 translated into no significant trend over the entire 5-year period. There was no significant trend for the homicide rate over the 5 years, but a significant decrease (of 68%) over the 2008 to 2011 period. The trends for deaths of undetermined intent were relatively flat.

Figure 4. Age-standardized annual rates (/100,000) of fatal injuries among Hawaii residents, by intent, 2007-2011.

(Rates for all types of injuries are indicated by bars.)



The leading causes of fatal injuries varied by the age group of the victims (Figure 5). Suffocation was a leading cause of injury mortality in the very youngest and oldest age groups, but not in the intervening ages. Car crashes were the 2nd leading cause of injury mortality among 1 to 34 year olds, but this category decreased in rank across most of the succeeding age groups. Suicide was the leading cause of injury mortality among victims aged 15 to 74 years, although falls were a far more frequent cause in the oldest age group. Poisonings were common only among the 15 to 64 year-old victims, but the 3rd leading cause for all ages. The associations between age and other demographic variables will be explored more fully for each category in later sections of this report.

Figure 5. Five leading causes of fatal injuries among Hawaii residents, by age group, 2007-2011.

Rank	infants (32 total)	1-14 y (66)	15-24 y (368)	25-34 y (376)	35-44 y (466)	45-64 y (1,104)	65-74 y (230)	75+y (713)	total (3,355)
1	suffocation 22	drowning 16	suicide 125	suicide 124	suicide 138	suicide 291	suicide 55	falls 377	suicide 795
2	unk. intent 3	mvc*- occupant 12	mvc*- occupant 91	mvc*- occupant 56	poisoning 112	poisoning 284	falls 53	suffocation 85	falls 541
3	homicide 2	mvc*- pedestrian 9	mvc*- motorcyclist 32	poisoning 44	unk. intent 46	unk. intent 160	mvc*- pedestrian 22	suicide 57	poisoning 490
4	natural/ environ. 2	homicide 8	poisoning 29	mvc*- motorcyclist 37	mvc*- occupant 40	drowning 68	suffocation 16	mvc*- pedestrian 39	mvc*- occupant 290
5	exposure, drowning, animal 1 (each)	suicide 5	drowning 25	unk. intent 33	falls 29	falls 63	mvc*- occupant 15	mvc*- occupant 22	unk. intent 283

*mvc = motor vehicle crash

Nonfatal injuries

There was an annual average of 85,556 nonfatal injuries that required treatment at Hawaii hospitals over the 5-year period (Table 2). Most (93%, or 79,576) of those were treated in the ED setting, as these less severe injuries outnumbered those requiring hospital admission (5980 per year) by over a 13-to-1 ratio. Among residents of Honolulu County, there were generally consistent increases in the annual number of both nonfatal injuries treated in EDs and those requiring hospitalization. In contrast, the number of nonfatal injuries requiring hospitalization generally decreased among residents of other counties. Since the estimated population increased by at least 6% in each county over the 2007 through 2010 period, however, there were significantly decreasing trends in the annual rates of nonfatal injuries, at either level of hospital treatment. The only exceptions were ED visits among Kauai County residents, and hospitalizations among residents of Honolulu County.

Table 2. Annual number of nonfatal injuries treated in Hawaii hospitals, by county of residence of patient, 2007-2011.

County of residence	2007	2008	2009	2010	2011	annual average
Emergency department records						
Hawaii	14209	13349	13796	13203	13640	13639
Honolulu	51279	50350	51296	52275	53017	51643
Kauai*	6244	6500	6421	6492	6419	6415
Maui	7966	7845	7663	7932	7983	7878
state	79698	78044	79176	79902	81059	79576
Hospital admission records						
Hawaii	952	952	871	774	774	865
Honolulu*	3974	3972	4022	4230	4328	4105
Kauai	312	339	290	290	275	301
Maui	739	741	678	711	675	709
state	5977	6004	5861	6005	6052	5980
Total						
Hawaii	15161	14301	14667	13977	14414	14504
Honolulu	55253	54322	55318	56505	57345	55749
Kauai	6556	6839	6711	6782	6694	6716
Maui	8705	8586	8341	8643	8658	8587
state	85675	84048	85037	85907	87111	85556

*Indicates non-significant trend in the annual rate of nonfatal injuries for the 2007-2010 period, adjusted for total population.

Most of the injuries treated in EDs (92.7%) and requiring hospitalization (86.2%) were coded as unintentional or “accidental” (Table 3). These proportions were fairly constant across the 4 counties. Assaults constituted 3% to 6% of injuries treated in both settings, while self-inflicted or suicidal injuries comprised a much greater proportion of injuries requiring hospitalization (6.7%), compared to injuries treated in EDs (0.6%). Injuries of undetermined intent generally comprised less than 2% of the injuries treated in EDs or requiring hospitalization

Table 3. Average annual number of nonfatal injuries treated in Hawaii hospitals, by intent of injury and county of residence of patient, 2007-2011.

	ED visits (%*)	hospitalizations (%*)	total (%*)
Hawaii County			
unintentional	12560 (93.3%)	764 (87.9%)	13324 (93.0%)
assault	742 (5.5%)	30 (3.4%)	772 (5.4%)
suicide	89 (0.7%)	60 (6.9%)	149 (1.0%)
undetermined intent	70 (0.5%)	15 (1.7%)	85 (0.6%)
total	13461	869	14330
Honolulu County			
unintentional	41510 (92.4%)	3012 (85.4%)	44522 (91.9%)
assault	2498 (5.6%)	216 (6.1%)	2714 (5.6%)
suicide	268 (0.6%)	251 (7.1%)	520 (1.1%)
undetermined intent	655 (1.5%)	49 (1.4%)	703 (1.5%)
total	44931	3528	48459
Kauai County			
unintentional	5711 (94.1%)	266 (88.5%)	5977 (93.8%)
assault	223 (3.7%)	7 (2.5%)	231 (3.6%)
suicide	47 (0.8%)	16 (5.4%)	63 (1.0%)
undetermined intent	88 (1.5%)	11 (3.7%)	99 (1.6%)
total	6069	300	6370
Maui County			
unintentional	6817 (92.1%)	614 (84.4%)	7430 (91.4%)
assault	461 (6.2%)	47 (6.4%)	507 (6.2%)
suicide	27 (0.4%)	47 (6.5%)	74 (0.9%)
undetermined intent	95 (1.3%)	19 (2.7%)	114 (1.4%)
total	7400	727	8125

*Percent of injuries within each county. Does not include injuries from legal interventions (0.3% of the total), or records without e-codes (8.7% of the total).

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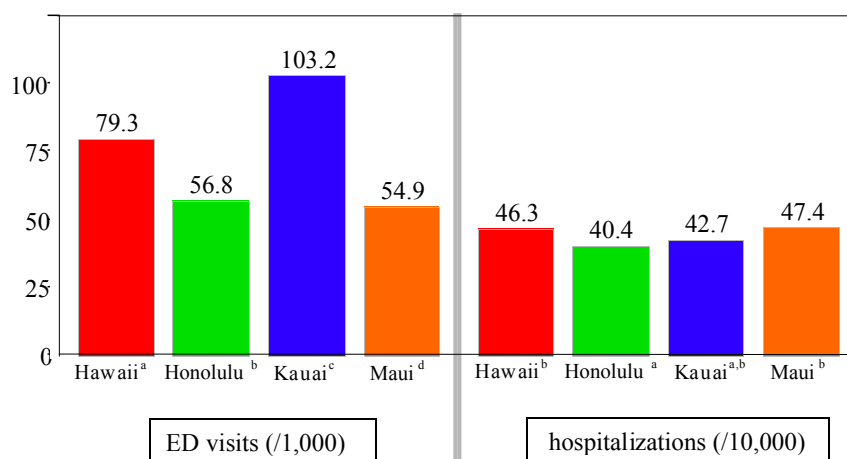
	ED visits (%*)	hospitalizations (%*)	total (%*)
state			
unintentional	66597 (92.7%)	4655 (85.8%)	71253 (92.2%)
assault	3924 (5.5%)	300 (5.5%)	4224 (5.5%)
suicide	431 (0.6%)	375 (6.9%)	806 (1.0%)
undetermined intent	908 (1.3%)	94 (1.7%)	1002 (1.3%)
total	71860	5424	77285

*Percent of injuries within each county. Does not include injuries from legal interventions (0.3% of the total), or records without e-codes (8.7% of the total).

Residents of Kauai had the highest rate of nonfatal injuries treated in EDs, nearly double the rates computed for residents of Honolulu and Maui counties (left side of Figure 6). The rate for Hawaii County residents was also significantly higher than rates for Honolulu and Maui counties, but 23% lower than the rate for Kauai County. There was a different pattern for rates of hospitalizations, as residents of Honolulu had a significantly lower rate than residents of Hawaii or Maui counties. The hospitalization rates for Hawaii, Kauai and Maui counties were statistically comparable, although 6% to 17% higher than the rate for residents of Honolulu County. The combined rate (nonfatal injuries in either setting) for residents of Maui and Honolulu counties were statistically comparable (597/1,000 and 608/1,000, respectively), while the rate for residents of Kauai and Hawaii counties were significantly different than any other county (1075/1,000 and 840/1,000, respectively).

Figure 6. Age adjusted annual rates of nonfatal injuries requiring treatment in emergency departments and hospitalization, by county of residence of patient, 2007-2011.

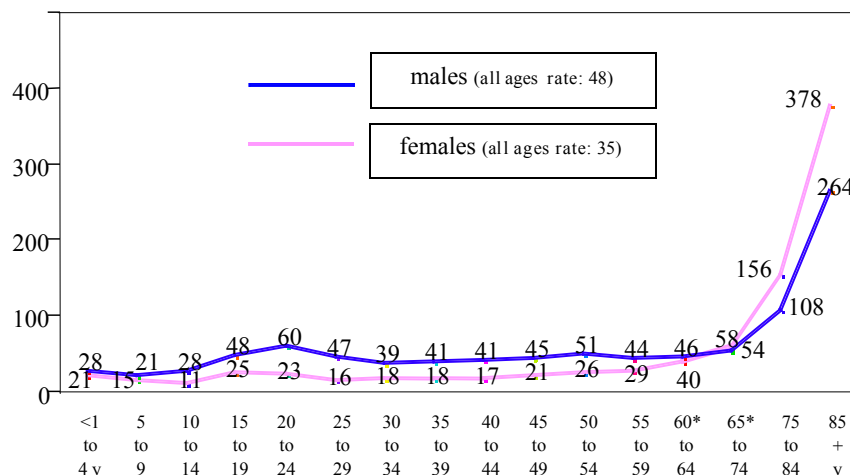
(Note scale difference for ED and hospitalization rates.)



(Counties with the same superscripted letter have statistically comparable rate estimates.)

Males comprised about 54% of Hawaii residents who were hospitalized for nonfatal injuries, and males had significantly higher (by 37%) rates of hospitalization for nonfatal injuries compared to female residents (Figure 7). Rate differences were greatest in the 20 to 24 age group, gradually narrowing over the adult age range before becoming comparable for ages 60 to 74 years. Females had significantly higher rates among residents aged 75 years and older.

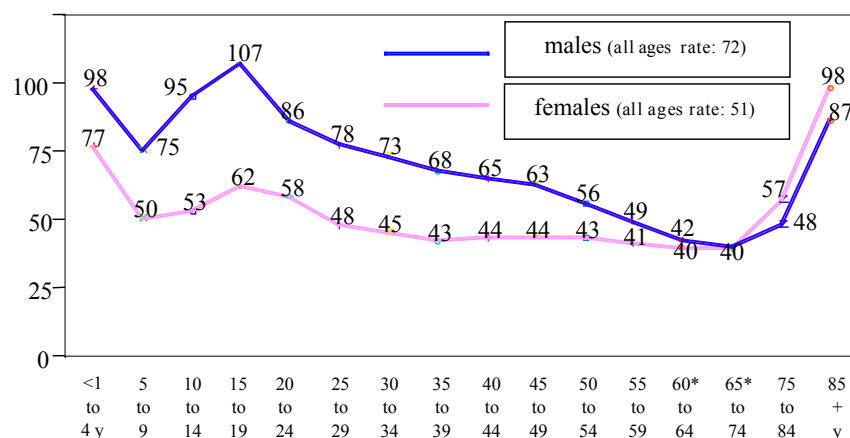
Figure 7. Average annual rates (per 10,000 residents) of hospitalization for nonfatal injuries in Hawaii, by age of patient, 2007-2011.



*Indicates non-significant difference in rates between males and females.

There was a slightly greater gender disparity for nonfatal injuries that were treated in EDs, as the rate for male residents was 41% higher than that for females (Figure 8). Male patients outnumbered females overall (59% vs. 41%), but gender distribution varied by age. Males comprised nearly two-thirds (65%) of the patients aged 10 to 29 years, but females made up the majority (60%) of those 65 years and older. These relationships were reflected in the age-specific rate estimates, where the greatest gender differences were seen for the 10 to 29 year age range, especially among males aged 15 to 19 who had the highest rates. Rates declined in both genders over the 15 to 74 year age range, before increasing. Females aged 75 and older had significantly higher rates than male residents.

Figure 8. Average annual rate (per 1,000 residents) of ED visits for nonfatal injuries in Hawaii, by age of patient, 2007-2011.



*Indicates non-significant difference in rates between males and females.

The leading causes of nonfatal injuries differed between those requiring hospitalization (Figure 9) and those treated in EDs (Figure 10), and also differed by patient age within each of those settings. Falls were the leading cause of injuries requiring hospitalization at nearly every age group except for 15 to 34 year-old patients, among whom motor vehicle occupant injuries were the most common. Car crashes and suicide attempts were the 2nd leading cause for most age groups, although assaults were the 2nd most common cause among infants. Poisonings were prominent causes of hospitalizations for senior age groups, while assaults and motorcycle crashes were more common for patients aged 15 to 64 years.

Figure 9. Five leading causes of nonfatal injuries requiring hospitalization among Hawaii residents, by age group, 2007-2011. (Average annual number.)

Rank	infants (46 total)	1-14 y (466)	15-24 y (713)	25-34 y (571)	35-44 y (507)	45-64 y (1,268)	65-74 y (511)	75+y (1900)	total (5,980)
1	falls 14	falls 154	mvc- occupant 114	mvc- occupant 81	falls 88	falls 448	falls 313	falls 1,523	falls 2,705
2	assault 3	striking 34	suicide 96	assault 76	suicide 64	suicide 105	mvc- occupant 25	mvc- occupant 39	mvc- occupant 414
3	fire/burn 2	mvc- pedestrian 24	falls 92	falls 73	assault 56	mvc- occupant 84	poisoning 17	poisoning 30	suicide 361
4	suffocation 2	fire/burn 24	assault 92	suicide 68	mvc- motorcy- clist 53	mvc- motorcy- clist 82	mvc- pedestrian 16	striking 24	assault 307
5	poisoning 2	mvc- bicyclist 23	mvc- motorcy- clist 58	mvc- motorcy- clist 61	mvc- occupant 51	poisoning 76	striking 12	over- exertion 21	mvc- motorcy- clist 276

mvc = motor vehicle crash

Falls were also the leading cause of nonfatal injuries that were treated in EDs for all ages considered together and within most age groups (Figure 10). Injuries from being “struck by objects or persons” were the leading cause for 15 to 34 year-olds, and the 2nd leading cause for the youngest (under 15 years of age) and oldest (75 years and older) patients. Cutting and piercing injuries were prominent, being the 3rd leading cause among 1 to 44 year-old patients. Most of these (57%) were coded as injuries from “other” objects, including broken glass and nails. Knives caused 21% of these injuries, and 4% were from powered hand tools. Car crashes were the 5th leading cause overall.

Figure 10. Five leading causes of nonfatal injuries requiring treatment at emergency departments among Hawaii residents, by age group, 2007-2011.

Rank	infants (874)	1-14 y (17,599)	15-24 y (13,957)	25-34 y (11,553)	35-44 y (9,491)	45-64 y (16,163)	65-74 y (3,612)	75+y (6,328)	total (79,576)
1	falls 474	falls 6,154	striking ¹ 2,555	striking ¹ 1,687	falls 1,438	falls 3,900	falls 1,431	falls 4,000	falls 20,920
2	striking ¹ 94	striking ¹ 3,541	falls 2,028	falls 1,495	striking ¹ 1,245	cut/pierce 1,876	cut/pierce 357	striking ¹ 364	striking ¹ 11,572
3	natural/ environ. ² 40	cut/pierce 1,024	cut/pierce 1,388	cut/pierce 1,479	cut/pierce 1,189	striking ¹ 1,767	striking ¹ 318	cut/pierce 230	cut/ pierce 7,563
4	poisoning 26	over- exertion ³ 971	over- exertion ³ 1,358	over- exertion ³ 1,340	over- exertion ³ 1,087	over- exertion ³ 1,477	over- exertion ³ 200	mvc- occupant 187	over- exertion ³ 6,618
5	fire/burn 25	natural/ environ. ² 922	assault 1,303	assault 974	assault 659	mvc- occupant 1,013	mvc- occupant 189	over- exertion ³ 172	mvc- occupant 4,204

mvc = motor vehicle crash

¹Most (92%) of these were coded as “struck accidentally by objects or persons”, most commonly (20%) in sports.

Also includes 8% that were struck by “falling object”.

²Unintentional injuries from “natural and environmental factors”. Most commonly consisted of dog bites (36%), bites from wasps and bees (11%), centipedes (11%), or marine animals or plants (6%).

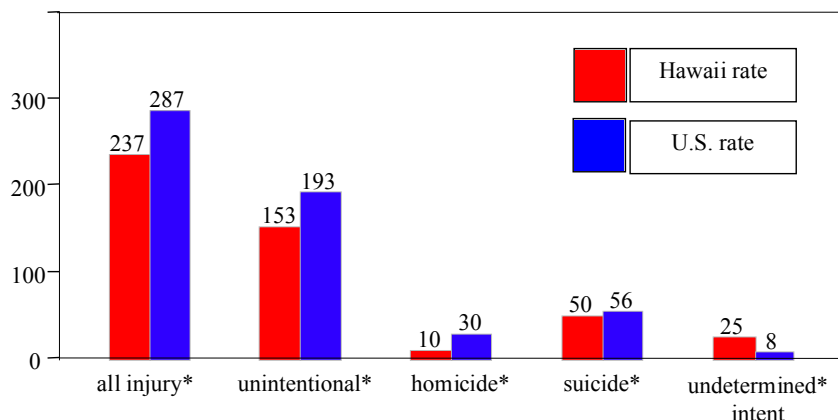
³Unintentional injuries from “overexertion and strenuous movements”, including injuries from “lifting, pulling, pushing”, and “excessive physical exercise”.

Comparisons with the Rest of the United States

Fatal injuries

The rate of fatal injuries in Hawaii was significantly lower (by 17%) than the rate for the rest of the U.S. Figure 11 shows there were significant differences in the rates of injuries for each type of intent. Fatal unintentional injury rates were 21% lower in Hawaii, and homicide rates in Hawaii were one-third of those for the rest of the U.S. The suicide rate for Hawaii residents was significantly lower than that for the rest of the U.S., but the rate of fatal injuries of undetermined intent was 3 times higher in Hawaii. This makes the interpretation of the respective suicide rates problematic, since most of the deaths of undetermined intent in Hawaii are thought to be possible suicides (see Figure 170).

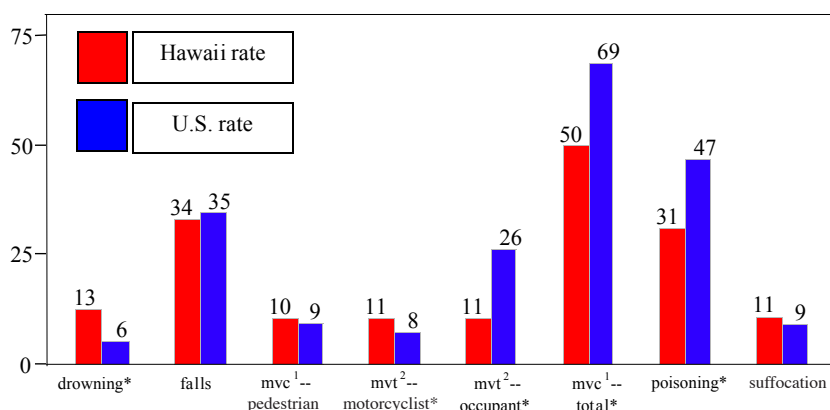
Figure 11. Age-standardized 5-year rates (/100,000) of fatal injuries among Hawaii and (non-Hawaii) U.S. residents, by intent, 2005-2009.



*Denotes statistically significant difference in rate between Hawaii and the rest of the U.S.

Fatality rates among car occupants were 58% lower for Hawaii residents, compared to other U.S. residents (Figure 12). This was the primary reason for the low rate of fatal unintentional injuries in Hawaii, compared to the rest of the U.S. Fatality rates for motorcyclists were significantly higher for Hawaii residents, but represented a less frequent cause of death. Drowning was the only other category for which the rate in Hawaii was significantly higher than that for the rest of the U.S. Rates of fatal falls and suffocations, and deaths among pedestrians were statistically comparable between Hawaii and the remaining U.S. residents. Hawaii had a significantly lower rate (by 34%) of unintentional poisonings, and also a significantly lower rate (by only 12%) if poisonings of all intent categories were considered (56 deaths/100,000 Hawaii residents, vs. 63/100,000 residents of other States). (Mode-specific traffic fatality rates are more reliably computed with FARS data (see figures 15 through 18), due to the sometimes imprecise characterization offered by death certificates. However, they are presented as part of this figure to disaggregate the overall difference in unintentional injury fatality rates shown in Figure 11.)

Figure 12. Age-standardized 5-year rates (/100,000) of fatal unintentional injuries among Hawaii and (non-Hawaii) U.S. residents, by category, 2005-2009.



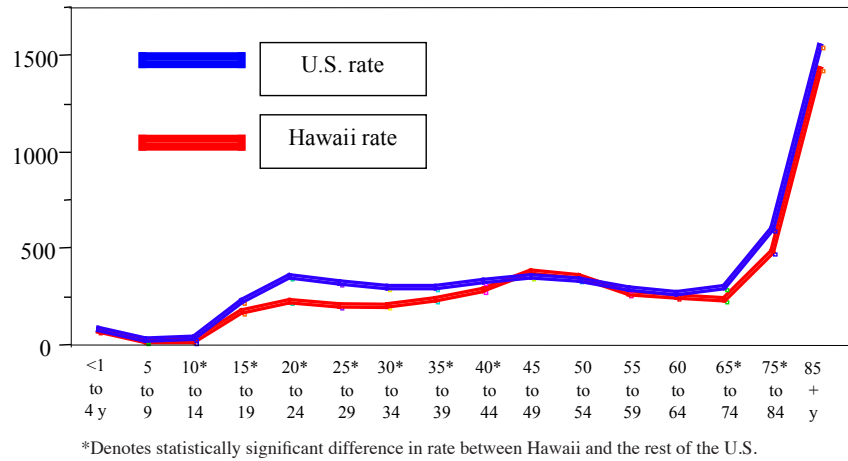
¹mvc=motor vehicle crash. Includes non-traffic fatalities (those not occurring on public roads).

²mvt=motor vehicle traffic. Includes only those fatalities that occurred on public roads.

*Denotes statistically significant difference in rate between Hawaii and the rest of the U.S.

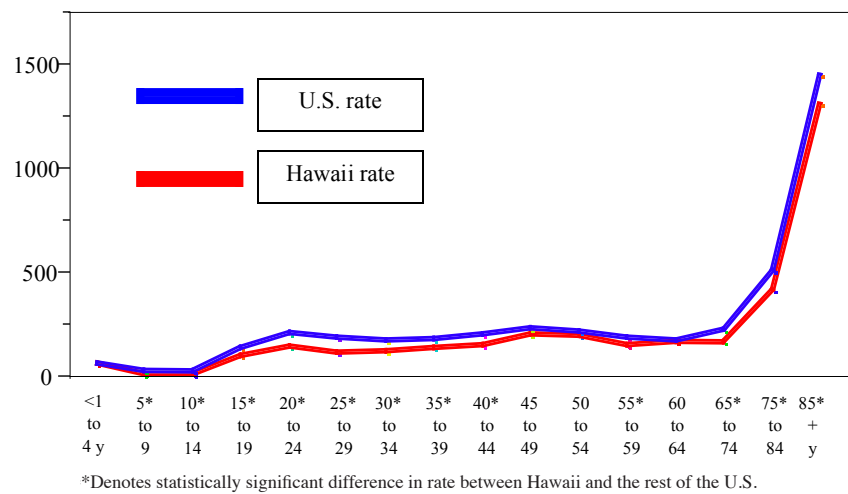
Rates of fatal injuries were significantly lower in Hawaii than in the rest of the U.S. for most of the age groups shown in Figure 13. The most pronounced differences were in early adulthood (from 15 to 34 years of age). The shape of the curve in Hawaii was otherwise similar to the rest of the U.S. In Hawaii, rates were relatively low during childhood, began to rise around 15 years of age, and then leveled off until a dramatic increase at about 75 years of age.

Figure 13. Five-year rates (/100,000) of fatal injuries among Hawaii and (non-Hawaii) U.S. residents, by age group, 2005-2009.



Rates of unintentional injuries (Figure 14) followed a similar age pattern to that for all types of injuries (Figure 13). Again, the (non-Hawaii) U.S. rate was higher than the Hawaii rate at nearly every age, except for residents under 5 years of age, and 45 to 54 year-olds.

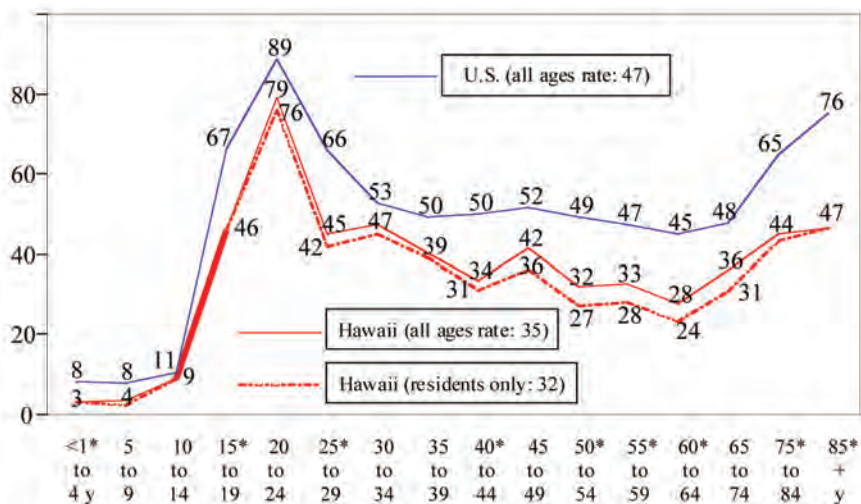
Figure 14. Five-year rates (/100,000) of unintentional injuries among Hawaii and (non-Hawaii) U.S. residents, by age group, 2005-2009.



Fatality rates from traffic crashes were significantly lower for Hawaii residents compared to the rest of the United States for most age groups, and 26% lower overall (Figure 15). Hawaii (including both resident and non-resident victims) had the 42nd highest fatality rate among the 50 states, which ranged from 108 deaths/100,000 (Wyoming), to 21 deaths/100,000 (Massachusetts). For both Hawaii and the rest of the U.S., the age pattern was similar: lowest rates through age 14, then rising sharply to a peak in the 15 to 29 year age group, followed by a gradual decline through age 64, before increasing again among senior-aged victims.

Figure 15. Four-year rates (/100,000) of fatal injuries from traffic crashes, Hawaii vs. rest of the U.S., by age group, 2007-2010.

(FARS data, which includes non-resident fatalities, but excludes non-traffic crashes.)

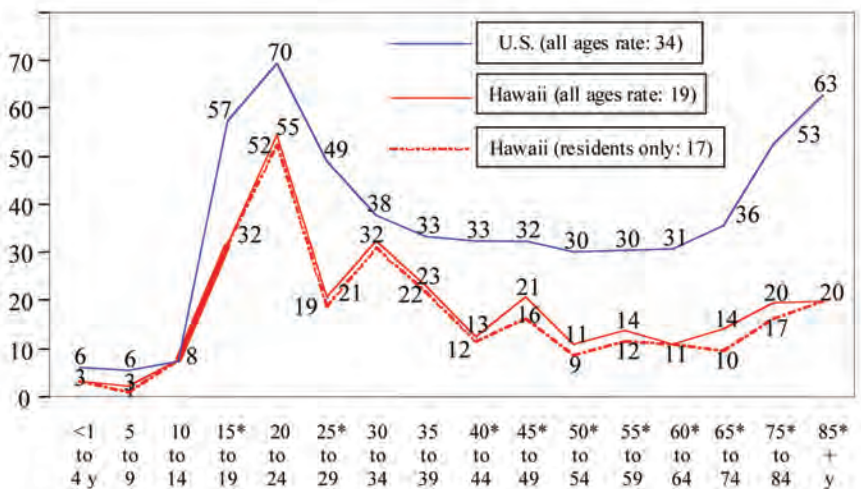


*Denotes statistically significant difference in rate between Hawaii (including deaths among residents and non-residents) and rest of U.S.

There was an even larger discrepancy when comparing car occupant fatality rates, as the rate for Hawaii residents and non-residents was about half (44% lower) that for the rest of the U.S. (Figure 16). Statistically significant difference were noted for nearly every age group above age 14. The rate of 19 death/100,000 for Hawaii was only the 46th highest rate among states. As per total traffic-related fatalities, Wyoming had the highest rate (90/100,000), and Massachusetts had the lowest (14/100,000). Since car occupants comprised the majority (72%) of traffic crash fatalities for the rest of the U.S., the age pattern is similar to that for all types of traffic-related fatalities (Figure 15): the sharp rise in rates for 15 to 24 year-olds, a general decline in rates for successive age groups until an increase among ages 65 and older.

Figure 16. Four-year rates (/100,000) of fatal traffic injuries among car occupants, Hawaii vs. rest of the U.S., by age group, 2007-2010.

(FARS data, which includes non-resident fatalities, but excludes non-traffic crashes.)

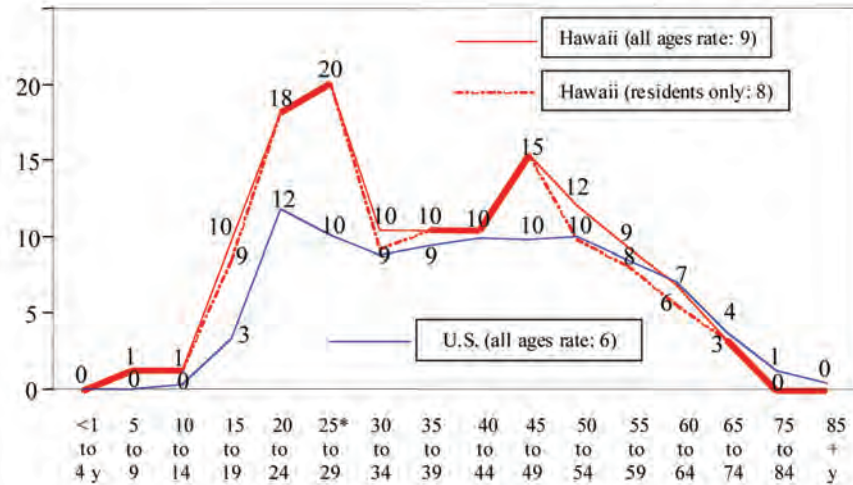


*Denotes statistically significant difference in rate between Hawaii (including deaths among residents and non-residents) and rest of U.S.

The age-standardized motorcyclist fatality rate for Hawaii residents was significantly greater than that for the rest of the U.S., and Figure 17 shows this is mostly due to elevated rates in the 20 to 29 year age groups in Hawaii. Overall, rates for Hawaii residents and non-residents were 50% greater, but 73% higher for this age range (19 deaths/100,000 for Hawaii, vs. 11 for the rest of the U.S.). Fatality rates generally declined from the peak age of 20 to 24 years for both Hawaii and the rest of the U.S. For all ages, Hawaii (including both resident and non-resident victims) had the 10th highest fatality rate among the 50 states, with Wyoming again with the highest rate (15 deaths/100,000 (Wyoming), and Massachusetts the lowest rate (3 deaths/100,000)

Figure 17. Four-year rates (/100,000) of fatal traffic injuries among motorcyclists, Hawaii vs. rest of the U.S., by age group, 2007-2010.

(FARS data, which includes non-resident fatalities, but excludes non-traffic crashes.)

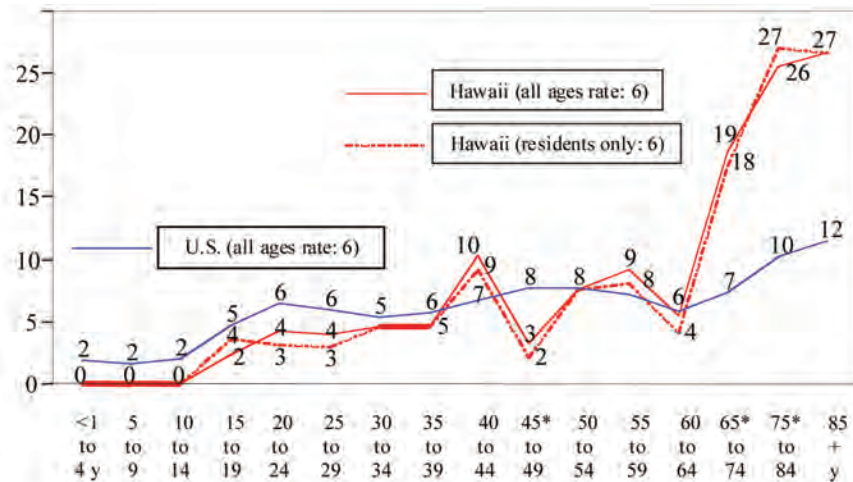


*Denotes statistically significant difference in rate between Hawaii (including deaths among residents and non-residents) and rest of U.S.

The all-ages pedestrian fatality rates were statistically comparable between Hawaii and the rest of the U.S. over the 4-year period (Figure 18). However, rates among senior-aged residents were significantly higher in Hawaii, with a more than two-fold difference for each senior age group. Although the highest rates for the rest of the U.S. were also seen among seniors, they were only about twice as high compared to rates among those 64 years of age and younger (9 vs. 5 deaths/100,000), while for Hawaii the rates for victims aged 65 years and older (22/100,000) were over 5 times higher than for younger residents (4/100,000). Fatality rates for almost all age groups younger than 65 years were statistically comparable between Hawaii and the rest of the U.S., with rates generally increasing with age.

Figure 18. Four-year rates (/100,000) of fatal traffic injuries among pedestrians, Hawaii vs. rest of the U.S., by age group, 2007-2010.

(FARS data, which includes non-resident fatalities, but excludes non-traffic crashes.)

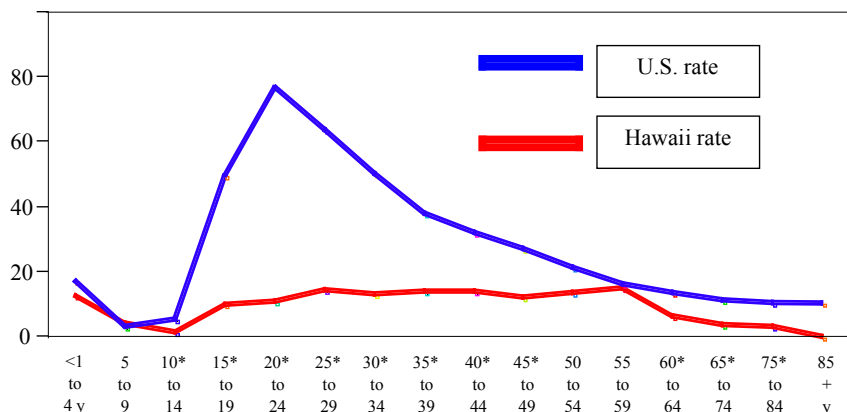


*Denotes statistically significant difference in rate between Hawaii (including deaths among residents and non-residents) and rest of U.S.

Hawaii had the 13th highest all-ages fatality rate among the 50 states, but by far the highest rate among senior-aged residents (22 deaths/100,000, compared to the next-highest rate of 15/100,000 for California). Hawaii had the highest senior-aged fatality rate in the country, whether computed with age adjusting or not, and whether including non-resident deaths or not. In fact, Hawaii had the highest rates within each of the 3 age groups in the senior age range.

Compared to the rest of the U.S., homicide rates were significantly lower in Hawaii for every age group between 10 and 84 years, except for the 50 to 59 year age range (Figure 19). There was a pronounced peak from 15 to 34 years of age in the U.S. that was largely absent among Hawaii residents.

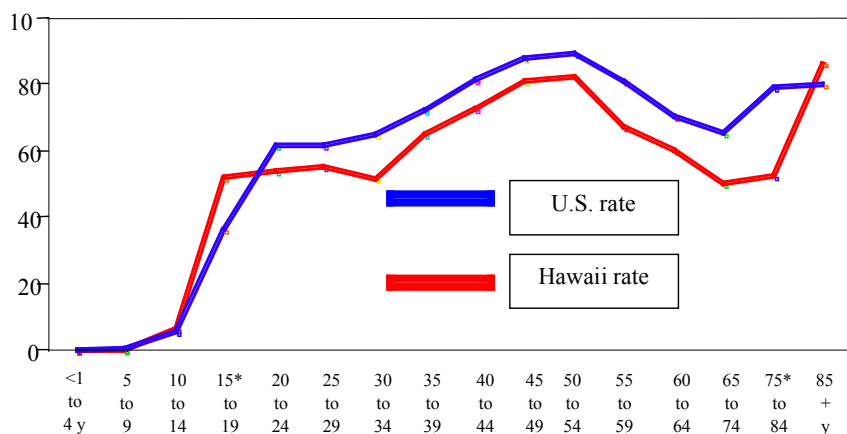
Figure 19. Five-year rates (/100,000) of homicides among Hawaii and (non-Hawaii) U.S. residents, by age group, 2005-2009.



*Denotes statistically significant difference in rate between Hawaii and the rest of the U.S.

Age-specific suicide rates were generally comparable between Hawaii and the rest of the U.S. (Figure 20). Rates were close to zero until the teenage years, rose sharply by age 15 and reached a peak in the 45 to 54 year age groups. Rates declined thereafter before rising sharply in old age (85 years or older). The rates in Hawaii were generally lower than rates for other U.S. residents at most adult age groups, although there were few statistically significant differences. Hawaii had a significantly higher rate among 15 to 19 year residents (52 deaths/100,000, based on 42 deaths), compared to the rest of the US (36 deaths/100,000).

Figure 20. Five-year rates (/100,000) of suicides among Hawaii and (non-Hawaii) U.S. residents, by age group, 2005-2009.



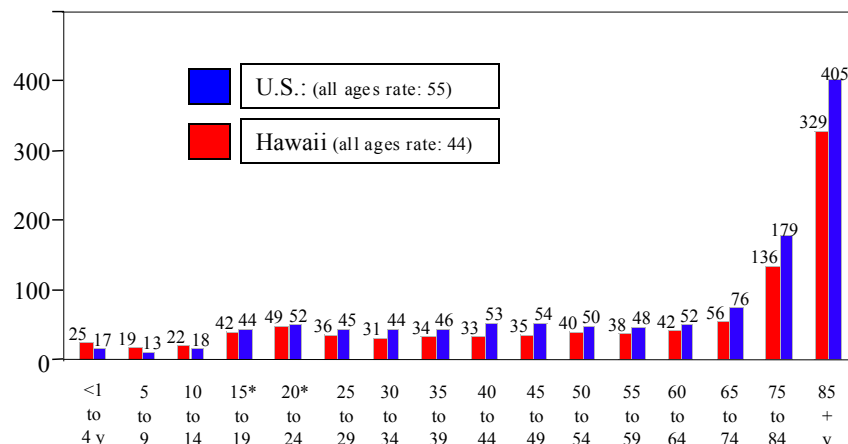
*Denotes statistically significant difference in rate between Hawaii and the rest of the U.S.

Nonfatal injuries

The rate of hospitalizations for nonfatal injuries was significantly lower (by 20%) for Hawaii residents compared to the U.S. as a whole (Figure 21). The rate was higher for Hawaii residents under 15 years of age, comparable for the 15 through 24 year age group, then higher for US residents at every succeeding age group. The largest discrepancies were computed for the 40 through 49 year age groups. Figure 21 also shows the association between age and rate of hospitalization was similar for Hawaii and the U.S.: rates were lowest for 5 to 14 year-olds, increased from ages 15 to 24, then stayed relatively constant until large successive increases beginning at 65 years of age. Rates for residents 75 years and older were 2 to 8 times higher than rates for most other age groups. Similar findings were noted when analyzing hospitalization rates within each gender. The standardized rate for Hawaii male residents was 43% higher than the rate for female residents of Hawaii (51 vs. 36 hospitalizations/10,000 residents).

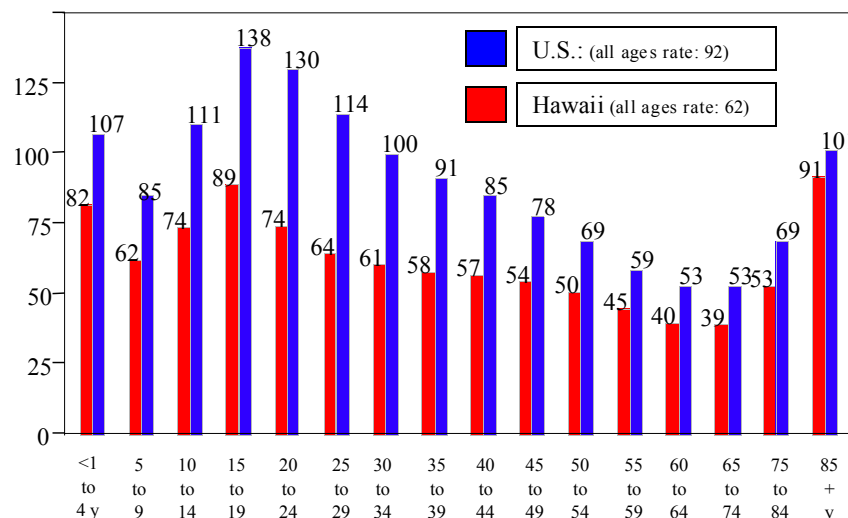
The age adjusted rate of ED visits for nonfatal injuries was 48% higher for the U.S. as a whole compared to rates for Hawaii residents (Figure 22). There were statistically significant differences in the rates at every age group, but the biggest differences were seen for the 20 to 34 year age ranges. The relationship between age and rates of ED visits was similar for Hawaii residents and the U.S., with peak rates in the 15 to 24 year age group and the 85 and older age group. A different pattern was seen for hospitalization rates, where there was a pronounced peak in the oldest age groups (see Figure 21). Rates of ED visits generally declined over the 24 to 74 year age range in both places. These patterns were also evident within each gender. Among Hawaii residents, the standardized rate for males (72/1,000 residents) was 44% higher than the rate for females (50/1,000 residents.)

Figure 21. Average annual rates of hospitalization (per 10,000 residents) for nonfatal injuries, Hawaii residents vs. the United States, by age of patient, 2005-2009.



*Indicates non-significant difference in rates for Hawaii and U.S.

Figure 22. Average annual rates of ED visits (per 1,000 residents) for nonfatal injuries, Hawaii residents vs. the United States, by age of patient, 2005-2009.



Unintentional Injuries Among Hawaii Residents

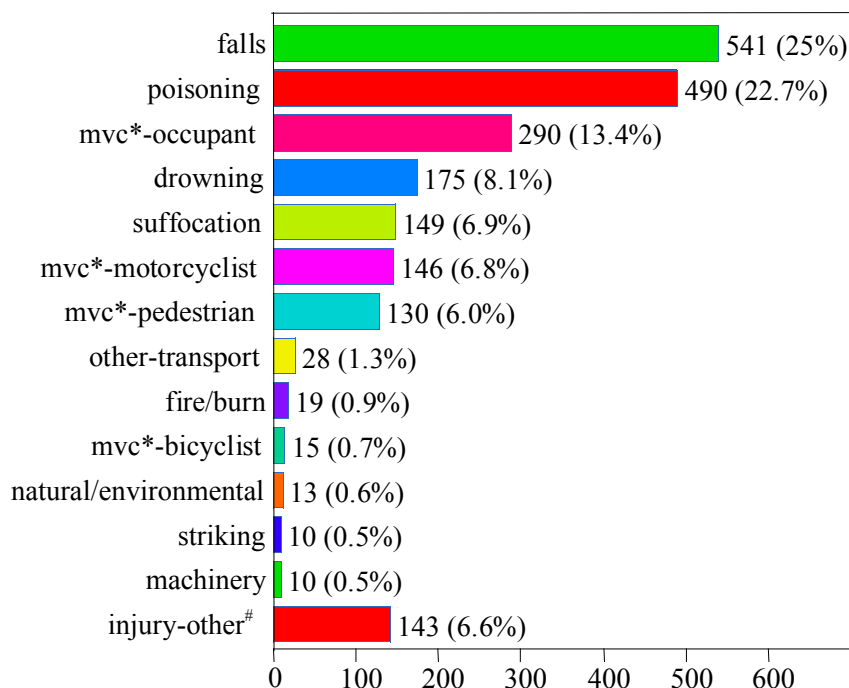
Fatal injuries

Motor vehicle traffic crashes were the dominant cause of the 2,159 unintentional injury deaths (Figure 23), although falls were the single leading cause. Deaths from poisonings accounted about nearly one-fifth of the total number of unintentional injury deaths. The 635 combined vehicular deaths accounted for 30% of the total number of unintentional injury deaths, including 328 deaths among drivers and occupants of motor vehicles (excluding motorcycles). Other common causes of unintentional injury deaths were drownings (7.6%), and suffocations (7.2%). The following sections will discuss these more common unintentional injury categories in more detail.

Unintentional injury deaths occurred at all ages, but Figure 24 below shows two particularly noticeable peaks: young adults (ages 15-64) and the elderly (over 75 years). Male victims outnumber females by more than 2-to-1, as 71% (1,533) of the 2,159 victims of unintentional injuries were males, and 29% (626) were females. Figure 24 shows that this gender disparity was lowest among the youngest (ages 0 to 14) and oldest (ages 75 and older) victims, although this equality in the latter is at least partly due to the relative longevity of females.

The age distribution varied somewhat by the category of injury death. For example, while drownings and bicyclist deaths were more evenly distributed across the age range, 80% of the fall victims were 65 years of age or older. Similarly, there was some variation in the proportion of gender by the category of injury. Males formed the vast majority of victims who died in motorcycle crashes (88%), bicycle crashes (88%), drownings (88%), and poisonings (78%). Although males still represented the majority, gender was more equally distributed among victims of falls (56%) and pedestrian fatalities (56%). The age and gender distribution of victims will be examined more closely in specific injury sections.

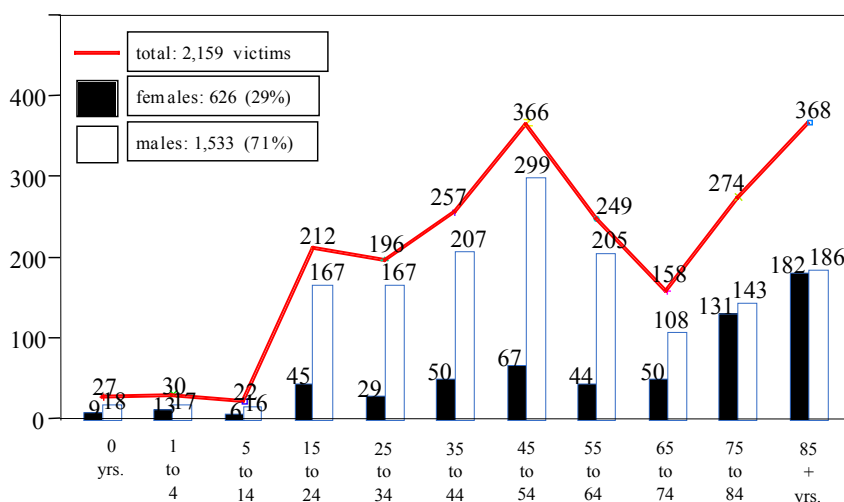
Figure 23. Fatal unintentional injuries among residents of Hawaii, by injury category, 2007-2011.



*mvc=motor vehicle crash.

#Most of these (87, or 61%) were due to "exposure to unspecified factor". There were also 6 electrocutions, and 39 deaths due to "late effects" (more than 1 year) from falls (14), car crashes (8) and unspecified mechanisms (17).

Figure 24. Age and gender distribution of victims of fatal unintentional injuries in Hawaii, 2007-2011.



More than two-thirds (69%, or 1,490) of the unintentional injuries occurred in Honolulu County. Of the remaining 669 fatalities on the Neighbor Islands, about half (51%, or 339) occurred in Hawaii County. There were 221 deaths in Maui County (10% of the state total), and 109 in Kauai County (7%).

Although the number of fatalities was by far greatest on Oahu, Figure 25 shows the rate was highest for residents of Hawaii County. The rates for Hawaii County was at least 17% higher than any other county, and significantly higher than the rates for Honolulu or Maui counties. The rates for Kauai, Maui and Honolulu counties were statistically comparable.

Figure 25. Number and rate of fatal unintentional injuries in Hawaii, by county of injury, 2007-2011.

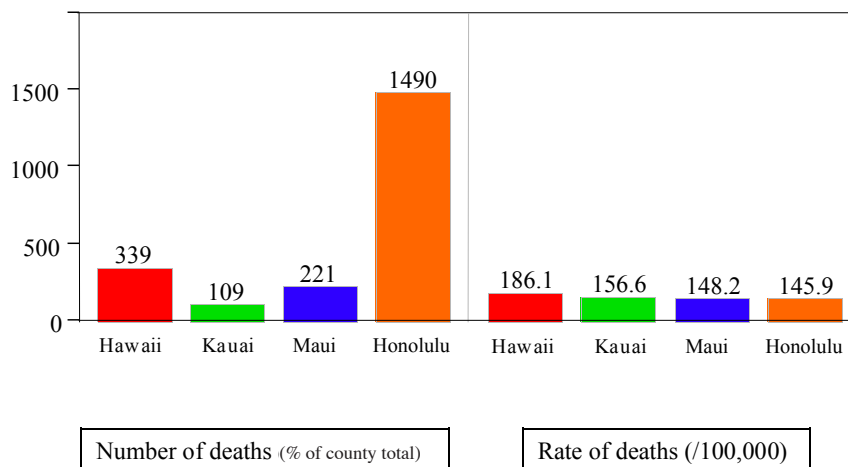
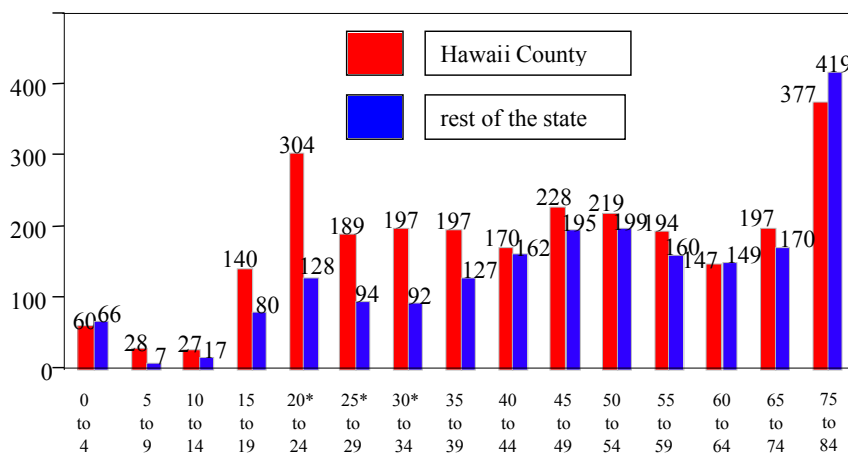


Figure 26 shows that unintentional injury rates were higher for Hawaii County residents at all ages, except for the youngest and oldest age groups. (Rates among residents 85 years and older are not shown, to conserve the scale of the graph. The rate for Hawaii County residents aged 85 and older was 1,064 deaths/100,000 residents, while the rate for the rest of the state was 1,256/100,000 residents.) Compared to residents of other parts of the state, rates among Hawaii County residents were approximately doubled for most of the age categories in the 5 through 39 year age range. Rates were more comparable across the two locales for the older victims (ages 60 and over).

Figure 26. Fatal unintentional injury rates (/100,000): residents Hawaii County vs. residents of other counties of Hawaii, by age group, 2007-2011.



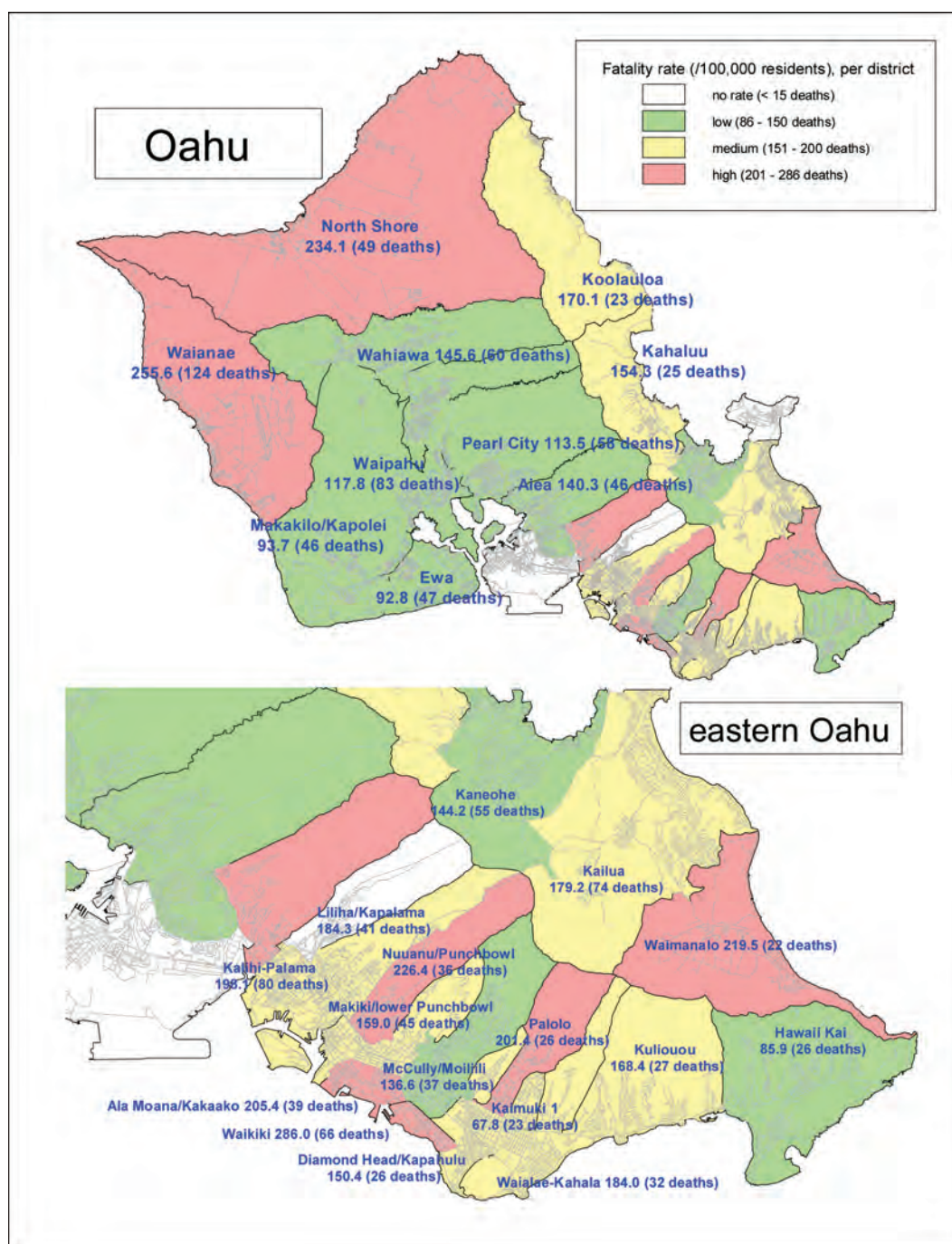
*Denotes statistically significant difference in rate between Hawaii County and the remainder of the state.

Hawaii County residents comprised 3032 of the victims killed in car crashes, 25% killed in motorcycle crashes, and 21% of those who drowned, although only 14% of the state population resided on the island of Hawaii over the 5-year period. These county disparities will be more fully examined in subsequent chapters.

There were relatively few neighborhoods within Honolulu and Maui counties with “high” unintentional injury fatality rates (Figure 20), although the 4 highest rates were computed for Neighborhood Boards on Oahu: Waikiki, Waianae, North Shore, and Nuuanu/Punchbowl. the North Shore and Waianae had the 3rd and 4th highest rates in the state, respectively. Most of central Oahu had “low” fatality rates (shown by green shading in Figure 27), while eastern Oahu had areas mostly in the “medium” or “high” rate categories (lower map on Figure 27).

Figure 27. Five-year rates of fatal unintentional injuries among Oahu residents, by Neighborhood Board, 2007-2011.

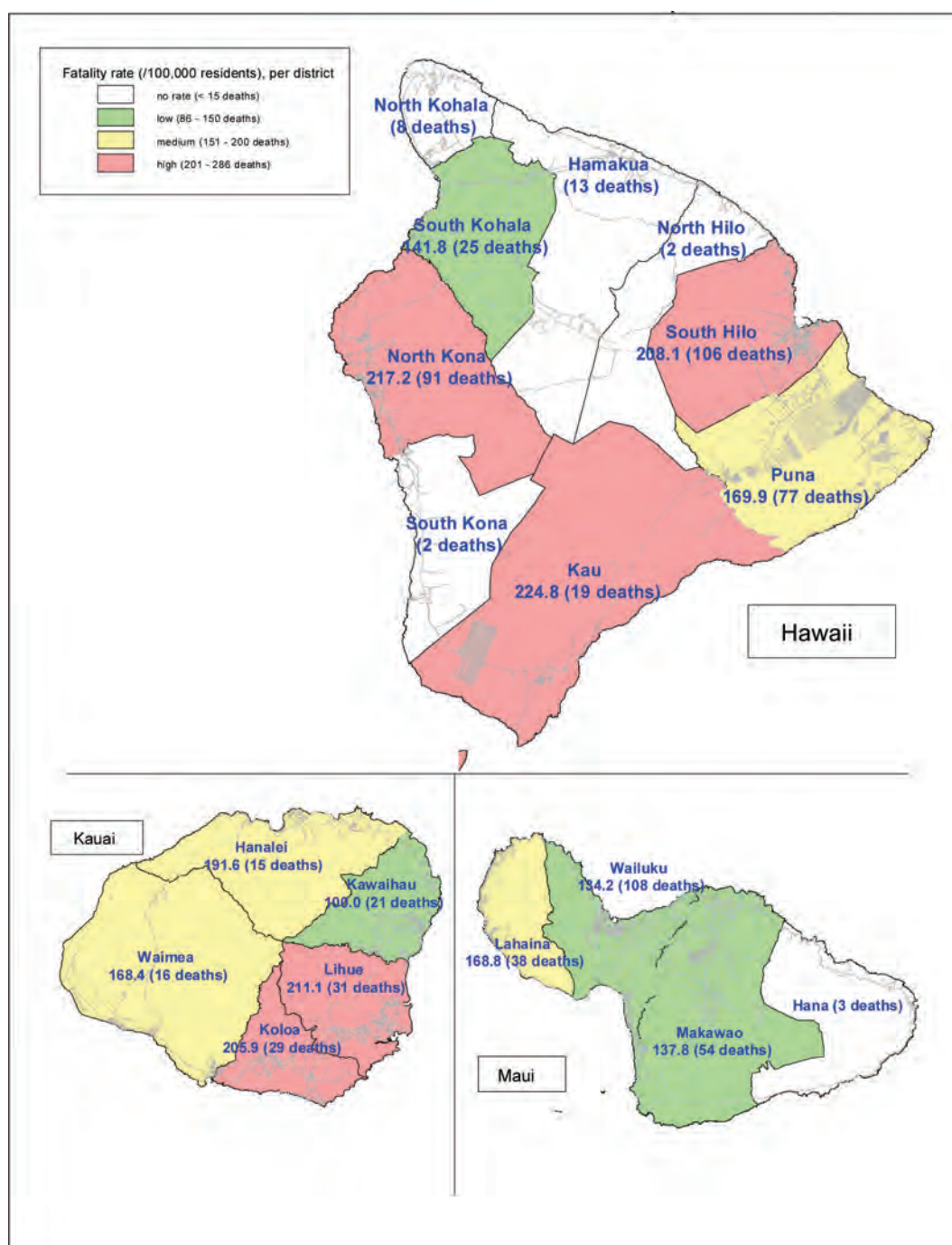
(Rate is per 100,000 residents, as estimated in 2010. Number of deaths is shown in parentheses.
Rates based on 30 or fewer deaths are unreliable and should be interpreted with caution.)



Residents for the most urbanized parts (North Kona and South Hilo) of the island of Hawaii were at the a higher risk of fatal unintentional injuries than residents of other areas of the County (Figure 28). Kau residents also had a high rate, but it was based on only 19 deaths over the 5-year period. Other “high” risk districts on the Neighbor Islands were Lihue and Koloa districts on Kauai. The island of Molokai had a high rate (218 deaths/100,000 residents), but this was based on only 16 deaths. There were only 2 deaths among residents of Lanai. (Molokai and Lanai are not depicted on the Figure.)

Figure 28. Five-year rates of fatal unintentional injuries among Neighbor Island residents, by district, 2007-2011.

(Rate is per 100,000 residents, as estimated in 2010. Number of deaths is shown in parentheses.
Rates based on 30 or fewer deaths are unreliable and should be interpreted with caution.)



There were significant differences in the rates of fatal unintentional injuries among the 8 main ethnicities residing in Hawaii (Figure 29). (These 8 ethnicities represented 91% (1975) of the 2159 total deaths from unintentional injuries.) Hawaiian and Japanese residents had the highest rates, significantly higher than rates for African-American, Chinese, Filipino and Samoan residents. Rates for Japanese residents were also significantly higher than those for Caucasian and Korean residents. Chinese residents had the lowest rates, significantly lower than any group with a rate higher than 100 deaths/100,000. The rates among African-Americans, Filipinos, Koreans, and Samoans were all statistically comparable.

Fatal unintentional injury rates were computed for different age groups within the 4 ethnicities in which there were at least 290 deaths (Figure 30). For all 4 ethnicities, the rates were lowest for the youngest residents (0 to 14 years), and then rose sharply after age 65. However, the shape of that overall rise varied between ethnicities. Hawaiians had the highest rates in all age groups between 15 and 64 years, significantly so for the 15 to 29 year age group. Japanese residents had the highest rates in the senior age range, significantly higher than any other ethnic group.

Figure 29: Unadjusted rates (/100,000) of fatal unintentional injuries, by ethnicity, 2007-2011.

(Number of deaths given in parentheses in bottom labels.)

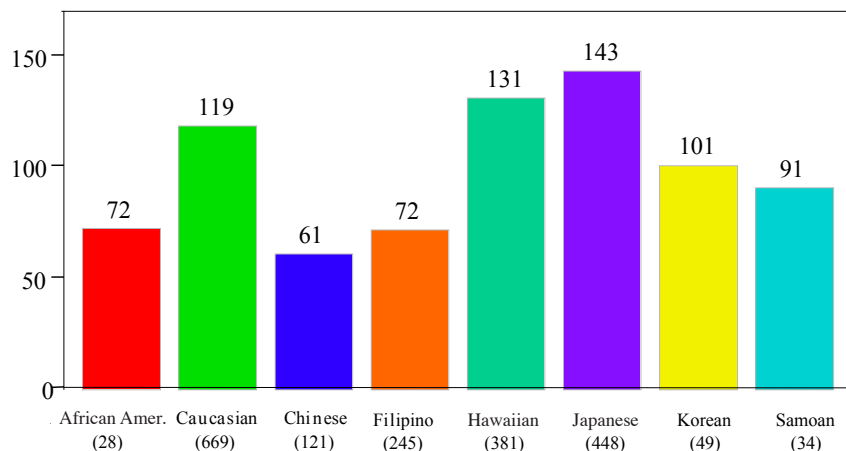
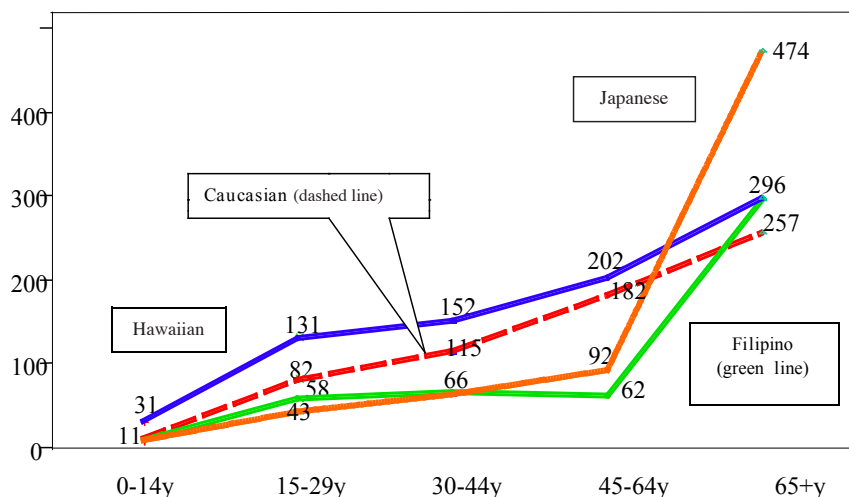
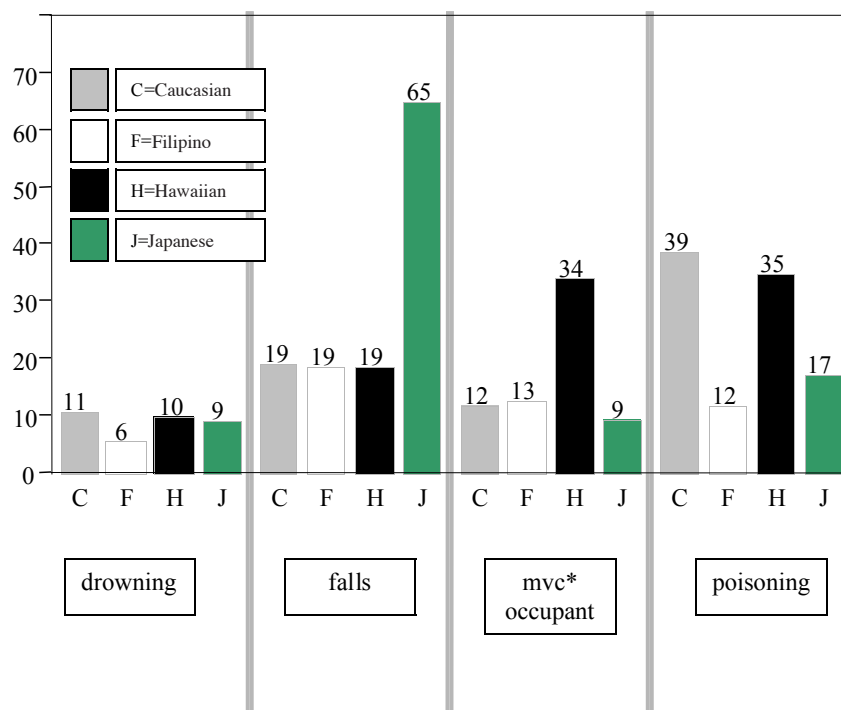


Figure 30: Unadjusted rates (per 100,000) of fatal unintentional injuries, by age group and ethnicity, 2007-2011.



Further analyses examined ethnic-specific rates for the leading unintentional categories of drowning, falls, motor vehicle occupant, and poisoning. These categories accounted for 70% (1,216) of the 1,743 fatal unintentional injuries among these 4 ethnicities. Figure 31 shows that much of the excess risk among Hawaiian residents is due to higher rates of death among motor vehicle occupants and poisonings, while much of the excess among Japanese residents is due to fatal falls (predominantly among victims aged 65 years or older). The drowning rates were generally comparable across the 4 ethnicities, although the rate for Filipinos was significantly lower than those for Caucasians or Hawaiians. The poisoning rates among Caucasian and Hawaiian residents were significantly higher than those for the other 2 ethnicities.

Figure 31: Unadjusted rates (per 100,000) of fatal unintentional injuries, by category and ethnicity, 2007-2011.



Nonfatal injuries

Falls were by far the leading cause of nonfatal unintentional injuries, accounting for more than half of those that required hospitalization, and about one-third of those treated in EDs (Figure 32). About three-quarters (78%) of the injury-related hospitalizations were caused by either falls (58%) or motor vehicle crashes (20%), most commonly injuries to automobile occupants (9%). The causes of injuries that were treated in EDs were more evenly distributed, including proportionally fewer injuries from falls and motor vehicle crashes, and more injuries from being struck by objects or persons, overexertion, cutting and piercing injuries, and natural and environmental causes. Drowning and suffocation comprised negligible amounts of unintentional injuries at either level of medical care, although they were important causes of fatal injuries (see Figure 23). Unintentional injuries from fires, machinery and firearms were also relatively rare in either medical setting.

Figure 32. Causes of nonfatal unintentional injuries among Hawaii residents, by level of medical care, 2007-2011.

(Percent of injuries by cause, average annual number listed in parenthesis.)

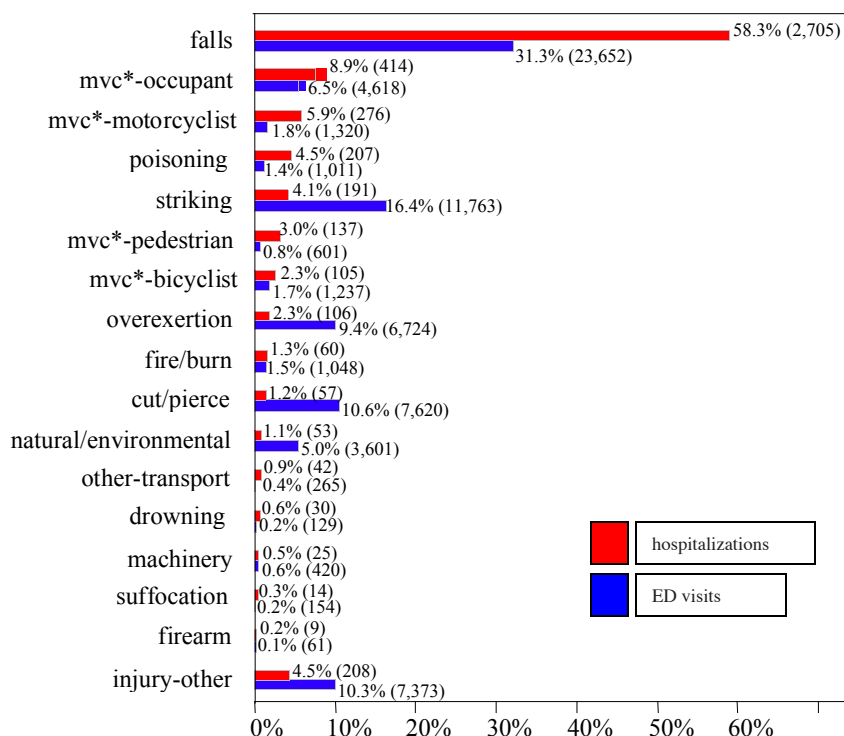


Table 4 lists the cause and average annual number of nonfatal unintentional injuries for each county of residence. The distribution of causes was generally similar across counties, with only a few exceptions. Proportionally more (60%) of injury-related hospitalizations among Honolulu County residents were due to falls compared to the other counties (51% to 54%), while automobile crashes were a less common cause among Honolulu County residents (8%, vs. 13% to 16% for other counties). Automobile crashes caused a larger proportion of injuries treated in EDs among Hawaii County residents (9%) than the other counties (around 6%).

**Table 4. Causes of nonfatal unintentional injuries,
by level of medical care and county of residence of patient.**

(Average annual number of injuries, percent of county total given in parenthesis.)

	Hawaii		Honolulu		Kauai		Maui	
Injury cause	ED	hosp.	ED	hosp.	ED	hosp.	ED	hosp.
falls	31.3% (3,908)	51.7% (381)	32% (13,342)	61.1% (1,867)	28.1% (1,613)	53.7% (137)	29.3% (2,057)	54.1% (320)
mvc*-occupant	8.2% (1,026)	14.5% (107)	5.8% (2,398)	6.8% (208)	5.7% (327)	12.2% (31)	6.5% (453)	11.4% (68)
mvc*-motorcyclist	1.7% (218)	6.4% (47)	1.3% (552)	5.3% (161)	1.5% (89)	6.6% (17)	2.6% (185)	8.6% (51)
poisoning	1.2% (155)	5.1% (37)	1.2% (502)	4.6% (141)	1% (59)	5.1% (13)	1.3% (88)	2.6% (15)
striking	15% (1,875)	3.5% (26)	17.7% (7374)	4.1% (125)	20.1% (1152)	4.5% (11)	16.7% (1170)	4.9% (29)
mvc*-pedestrian	0.5% (66)	1.9% (14)	0.8% (328)	3.5% (106)	0.4% (25)	1.6% (4)	0.6% (45)	2.1% (13)
overexertion	10.3% (1,282)	1.4% (10)	9.5% (3,975)	2.5% (76)	11.4% (652)	3.3% (8)	10.1% (710)	1.9% (11)
mvc*-bicyclist	1.5% (185)	2.1% (16)	1.7% (715)	2.1% (64)	1.8% (101)	3.1% (8)	1.9% (131)	2.8% (17)
cut/pierce	11.7% (1,462)	2% (15)	11% (4,588)	1% (30)	12.6% (725)	1.9% (5)	11.2% (788)	1.2% (7)
natural/envIRON.	5.7% (711)	2% (14)	4.9% (2,034)	1% (29)	6.4% (366)	0.9% (2)	6.2% (438)	1.1% (7)

*mvc = motor vehicle crash

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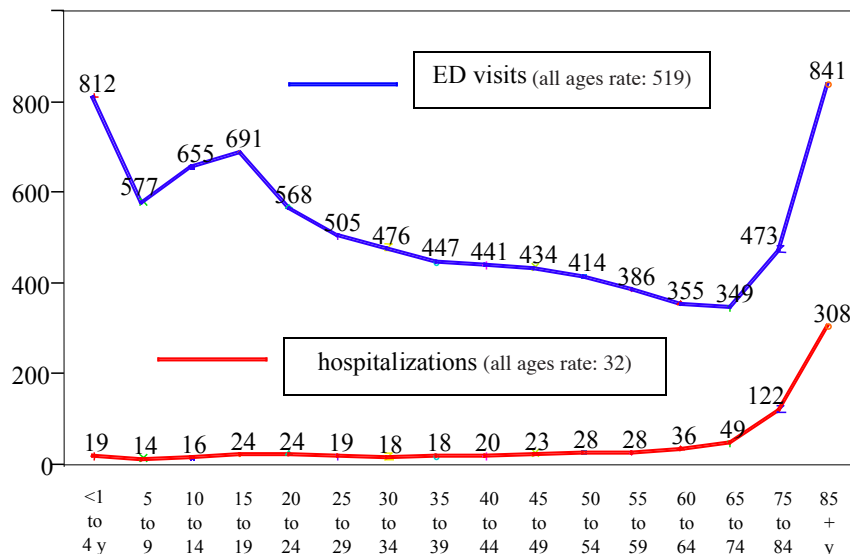
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	Hawaii		Honolulu		Kauai		Maui	
Injury cause	ED	hosp.	ED	hosp.	ED	hosp.	ED	hosp.
fire/burn	1.4% (176)	1.3% (9)	1.5% (616)	1.3% (39)	1.7% (100)	2% (5)	1.4% (95)	1% (6)
other-transport	0.4% (53)	1% (7)	0.3% (107)	0.8% (23)	0.5% (29)	1.5% (4)	0.5% (33)	1.3% (8)
machinery	0.7% (87)	0.8% (6)	0.5% (216)	0.4% (11)	0.5% (29)	0.3% (1)	0.9% (64)	1% (6)
drowning	0.1% (18)	0.7% (5)	0.2% (69)	0.6% (19)	0.1% (9)	0.5% (1)	0.1% (4)	0.7% (4)
suffocation	0.1% (16)	0.4% (3)	0.2% (83)	0.3% (9)	0.2% (10)	0.2% (0)	0.4% (31)	0.4% (2)
firearm	0.1% (14)	0.3% (2)	0.1% (26)	0.2% (5)	0.1% (4)	0.2% (0)	0.1% (8)	0.1% (1)
injury-other	10% (1250)	5.1% (37)	11.4% (4742)	4.5% (137)	7.9% (452)	2.6% (7)	10.3% (721)	4.5% (27)
total	12502	737	41666	3054	5742	256	7023	591

*mvc = motor vehicle crash

The rate for nonfatal unintentional injuries treated in EDs (519 injuries/10,000 residents) was 16 times higher overall than rates for injuries requiring hospitalization (32/10,000) (Figure 33). This ratio varied over the age range, however, with the highest disparities for residents under age 15 (approximately 40-to-1 ratio), and lowest among those aged 85 years and older (2.7-to-1). Rates for ED visits were highest for young residents (under 20 years of age) and those 85 years and older, and were progressively lower for the intervening age groups. The pattern was different for injuries requiring hospitalizations, with lowest rates for residents under 15 years of age, followed by a peak for 15 to 24 year-olds, and a much higher peak among senior aged residents.

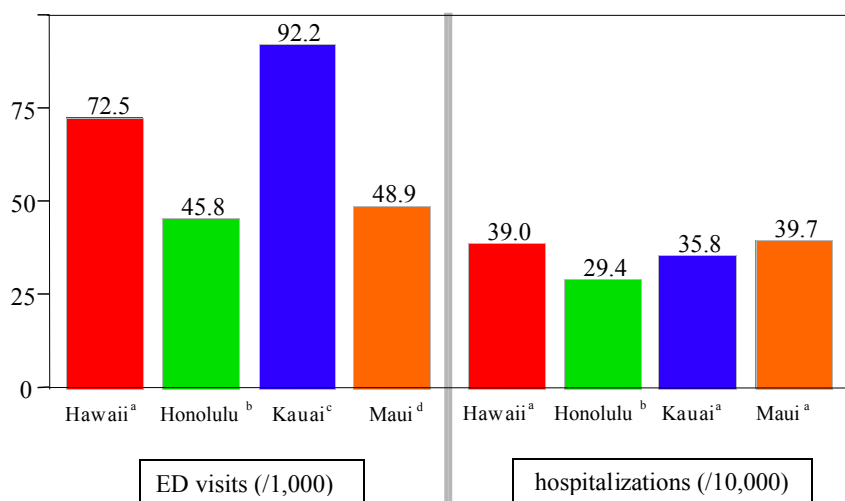
Figure 33. Average annual rates (per 10,000 residents) of hospitalizations and ED visits for nonfatal unintentional injuries in Hawaii, by age of patient, 2007-2011.



Residents of Kauai and Hawaii counties had the highest rates of unintentional injuries that were treated in EDs, approximately double the rates for Honolulu and Maui county residents (Figure 34). The rates for injuries requiring hospitalizations were more comparable across counties, although the rate for residents of Honolulu County was significantly lower than rates for residents of the other 3 counties.

Figure 34. Age adjusted annual rates of nonfatal unintentional injuries, by level of care and county of residence of patient, 2007-2011.

(Note scale difference for ED and hospitalization rates.)



(Counties with the same superscripted letter have statistically comparable estimates.)

Motor Vehicle Crashes

Fatal injuries

Deaths from motor vehicle crashes are categorized into 4 main types: those among the occupants of automobiles, motorcyclists, bicyclists and pedestrians. There is a separate chapter for each of these categories, since the demographics and risk factors are different for each. Figure 35 shows that half (50%, or 290) of the 581 residents who died in motor vehicle crashes were car occupants. About one-fifth (22%, or 146) were pedestrians, 25% were riding motorcycles or mopeds, and the remaining 3% were bicyclists.

If fatality rates are computed the usual way, per resident population, then rates will resemble the distribution of fatalities shown in Figure 35, i.e. the fatality rate for occupants is about 2 times that for motorcyclists or pedestrians; the same ratio as the number of decedents for each type of crash. This is because the denominator used for this type of rate (resident population) is the same for each type of decedent; differences in rates are only dependent on differences in the numerator (number of deaths). Using resident population as the numerator implies that every person is potentially a car occupant, motorcyclist, pedestrian or bicyclist. This assumption is made because there is usually no alternative data to describe a person's "exposure" that is consistent across modes of transportation. We can not directly compare, for example, a fatality rate for pedestrians (adjusted for population, since most people actually are pedestrians) with a fatality rate for motorcyclists (adjusted for the number of registered motorcycles).

Data from the National Household Travel Survey does provide common measures of exposure for different modes of travel. The NHTS was last conducted in 2009, and included data from 456 Hawaii residents from 228 households. Respondents were asked to keep a travel diary, from which the number of person trips were estimated for each mode of transportation. According to this survey, most (85.4%) trips in Hawaii were completed by passenger vehicle. Pedestrians accounted for most of the remaining trips (12.8%), followed by bicyclists (1.0%). None of those surveyed reported trips by motorcycle, so the 2001 NHTS estimate of 0.4% is used for trips by motorcycle in the calculations below. Figure 36 shows the relative differences in fatality rates when adjusted for population (left side of the graph) and number of person trips, using the NHTS data (right side). Car occupants clearly had the highest fatality rates for a given population, more than double the rates for pedestrians and motorcyclists, and 18 times that for bicyclists. Again, this is simply a reflection of the number of each type of fatality, as shown in Figure 35. When adjusted for the estimated number of person trips, however, motorcyclists had by far the highest fatality rate, and car occupants the lowest rate. For a given number of trips (1 million in this case), motorcyclists (26 deaths/million trips) were 123 times more likely to die in a crash compared to car occupants (0.21/million). Bicyclists and pedestrians were also significantly more likely to have been killed for a given number of person trips, compared to Hawaii residents who traveled by car. In summary, the NHTS exposure data suggests that travel by car is the safest mode in Hawaii, while motorcyclists are at the greatest risk for a given number of trips, followed by bicyclists and pedestrians.

Figure 35. Hawaii residents killed in motor vehicle crashes, by person type, 2007-2011.

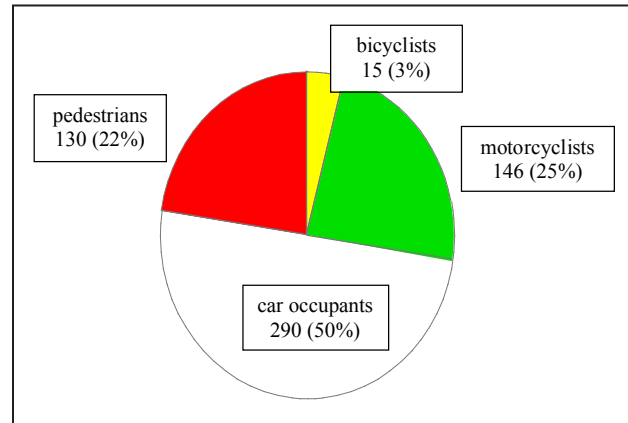
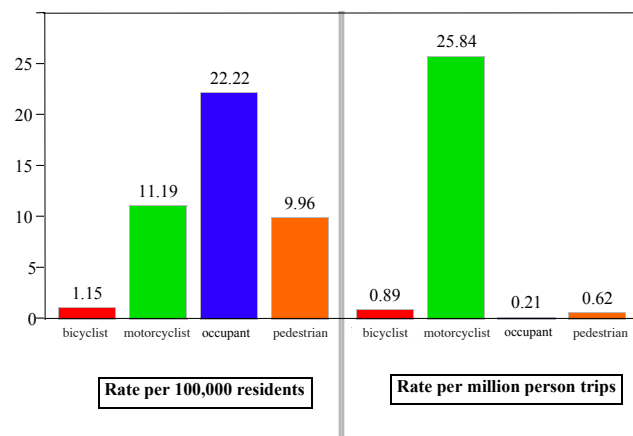


Figure 36. Five-year fatality rates from motor vehicle crashes in Hawaii, by person type, 2007-2011: Differences in per capita rates (left side) and rates based on person trips (right side).



Motor Vehicle Occupants

Fatal injuries

Motor vehicle crashes were the 3rd most frequent type of unintentional injury death in Hawaii, with 290 occupant fatalities over the 5-year period. There was a decreasing trend in the annual number of such deaths, from 69 in 2007 to 48 in 2011 (Figure 37). The 290 victims were killed in 268 separate crashes, as 249 (93%) of the crashes involved only a single fatality. There were 16 crashes with 2 victims each, and 3 crashes with 3 victims each. The 290 fatalities include 4 drivers of all terrain vehicles (ATVs), who are nonetheless technically considered “occupants”. All of these ATV-related deaths occurred in Hawaii County, and there was one death each year from 2008 to 2011.

Only 40% of the victims were injured in Honolulu County. Nearly one-third (94, or 32%) were killed in Hawaii County, which is notable since only 14% of the population of the state resides in this county. Maui and Kauai counties accounted for 16% and 12% of the victims, respectively. All but 4 of the 46 people who were killed in Maui County were injured on the island of Maui; there were 4 deaths on the island of Molokai.

The age distribution (Figure 38) showed a peak of fatalities in the 15 to 24 year age group. Almost one-third (91, or 32%) of the 290 victims were in this age range. Another 33% (96) of the victims were 25 to 44 years of age. Very few (13, or 4%) of the victims were under 16 years of age. Male victims (213) outnumbered females (77) by nearly a 2-to-1 ratio. The graph also shows that ratio was lower in the very young and very old age groups.

Figure 37. Annual number of fatally injured car occupants in Hawaii, by county, 2007-2011.

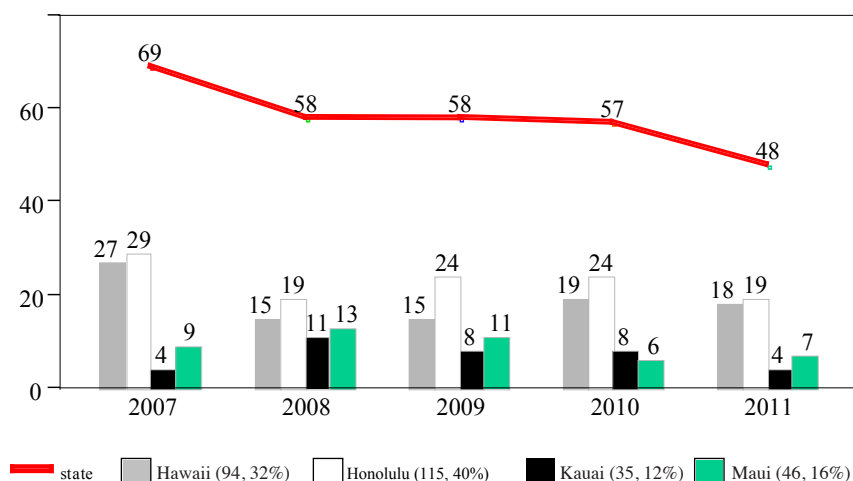
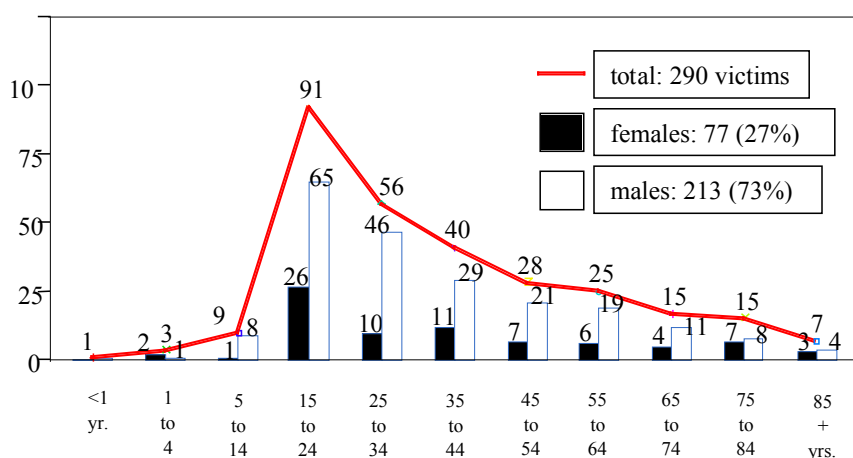


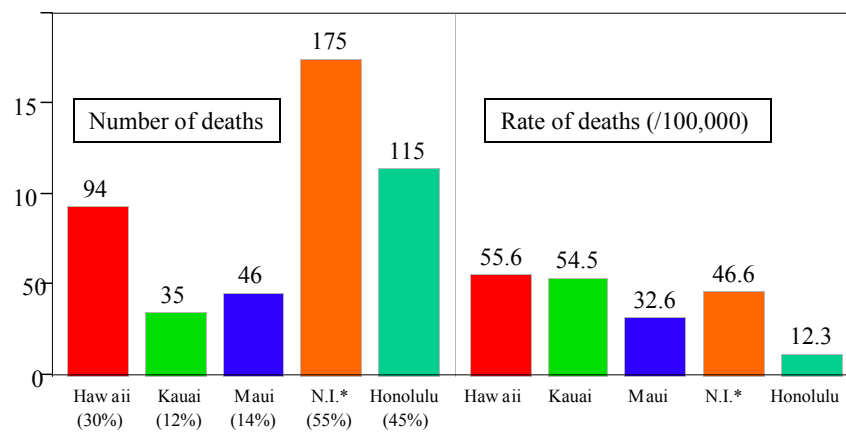
Figure 38. Age and gender distribution of fatally injured car occupants in Hawaii, 2007-2011.



Although the highest number of victims were injured on Oahu, the rate of fatal car occupant injuries was much higher among Neighbor Island residents (Figure 39). The rates for residents of Hawaii and Kauai counties were particularly high, nearly 4 times higher than that computed for Honolulu County. The rate for residents of Honolulu County was significantly lower than any other county. When considered as a whole, rates among Neighbor Island residents were more than 3 times higher than the rate for residents of Honolulu County. The rates for Hawaii and Kauai counties were statistically comparable, but significantly higher than the rate for residents of Maui County. (Results were similar if county-specific estimates for vehicle miles traveled were used as the rate denominator, instead of resident population.)

Figure 39. Number and rate of fatal injuries among car occupants in Hawaii, by county of injury, 2007-2011.

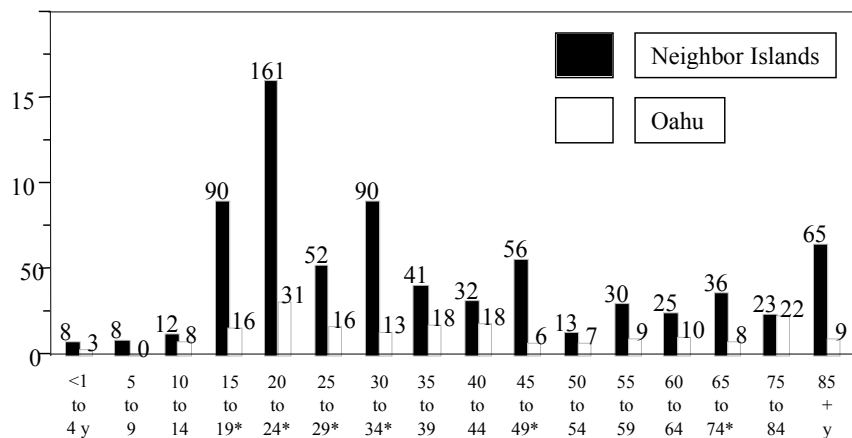
(Rate is per 100,000 residents, age adjusted to the 2000 U.S. population distribution.)



*N.I. = Neighbor Islands (combined totals for Hawaii, Kauai, and Maui counties.)

Figure 40 shows that the pronounced rate differences between Neighbor Island residents and Oahu residents are evident in almost every age group. The main exception is among victims younger than 15 years of age, where there were relatively few fatalities. Rates for Neighbor Island residents were significantly greater than for Honolulu residents for almost every age group from 15 to 49 years. The graph also shows the general pattern of car occupant fatality rates: very low before the age of 15, then rising sharply to a peak in the 20 to 24 year age groups, then gradually decreasing before another rise around 65 years of age.

Figure 40. Five-year rates (/100,000) of fatal car occupant injuries among residents of Oahu (white bars), and Neighbor Islands (black bars), by age group, 2007-2011.



*Denotes statistically significant difference in rate between Neighbor Island and Honolulu residents.

There was no noticeable seasonality in terms of the month of the year for the 304 crashes. Saturdays (59 crashes, 22% of the total) and Sundays (53 crashes, 20%) were the most common days for fatal crashes. (The crash date was not known for one victim.) More than half of the crashes (57%, or 151 of 264 crashes for which information was available) occurred during nighttime hours (7:30 p.m. to 5:30 a.m.), and more than one-third (36%, or 94 crashes) occurred during the 5-hour period from 9:31 p.m. to 2:29 a.m.

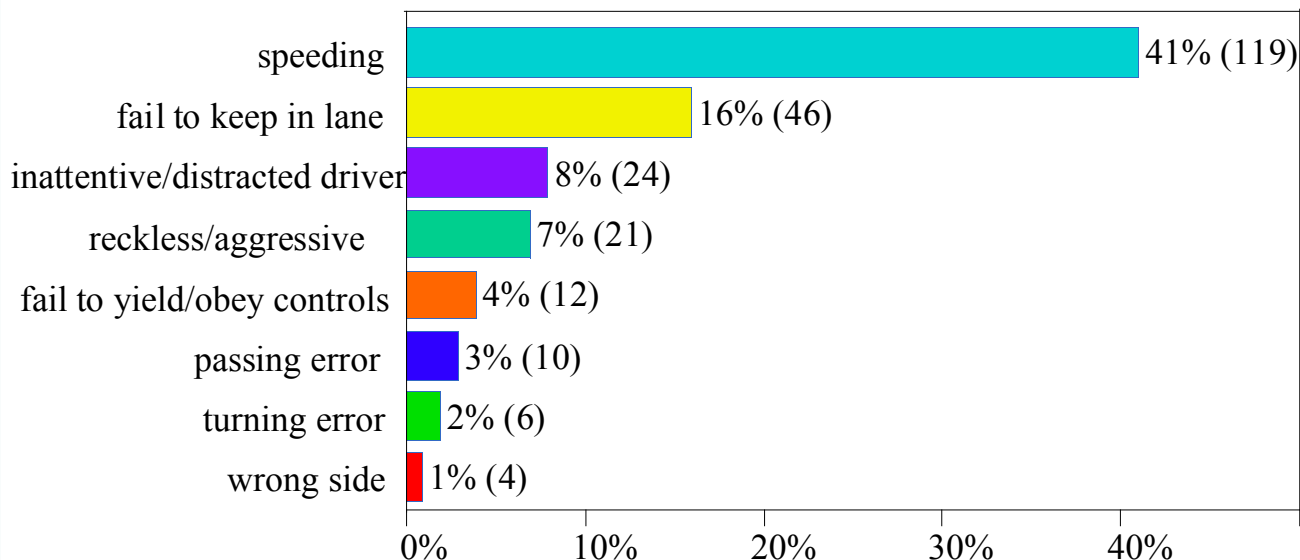
Most (93%, or 223) of the 242 fatalities that occurred from 2007 through 2010 could be linked to FARS records, which contain information on the involvement of alcohol, seat belt use and other risk factors in the crash. This data was available both for the crash decedents and other survivors involved in the crash. The remainder of this chapter (excluding the maps) utilizes FARS data, and is therefore restricted to the 223 victims who died in 201 traffic crashes (i.e. those that occurred on public roadways). These analyses also exclude 3 riders of ATVs, given the unique nature of those vehicles.

Lack of restraint use was a major risk factor for occupant fatalities, as less than half of the victims were wearing seat belts at the time of the crash: 47%, or 91 of the 193 victims for whom information was available. Restraint use was lowest among back seat passengers (25%, or 3 of 12 victims). Restrained victims were significantly older than unrestrained victims (average age: 43 vs. 30 years). Seatbelt use was inversely associated with alcohol, as only 40% of the victims in alcohol-related crashes were restrained, compared to 59% of those in crashes not involving alcohol. This association was stronger among drivers, as only 37% of the fatally injured drivers who had been drinking were restrained, compared to 66% of the drivers who had not been drinking.

More than half (61%, or 123) of the 201 fatal crashes involved only a single vehicle, and were likely related to the driver losing control of the car. There was no trend in the annual proportion of fatal crashes that involved only a single vehicle. Single vehicle crashes were slightly more likely to involve alcohol positive drivers than were crashes involving 2 or more cars (61% vs. 55%), although this was not a statistically significant difference.

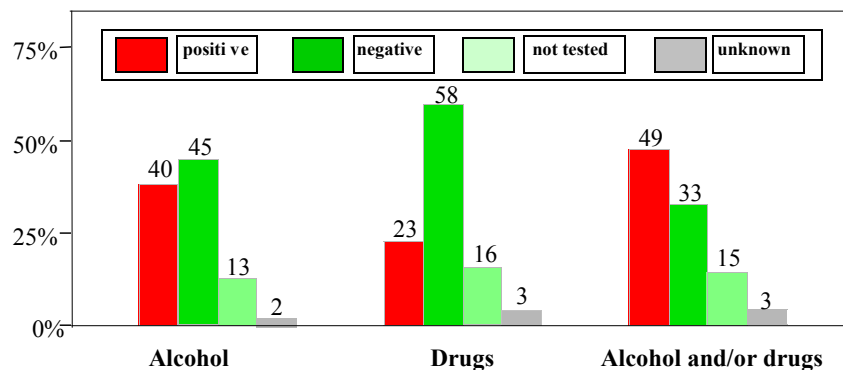
Among the 288 drivers involved in the fatal traffic crashes, the most common contributing factor was speeding, which was noted for 41% (119) of the drivers (Figure 41). There was no clear trend in the annual proportion of drivers who were speeding, which varied from 35% to 48%. Drivers who were speeding were significantly more likely to have a fatal injury (72%) compared to drivers who were not speeding (49%), partly because the former were much less likely to have been using seat belts (31% vs. 80%, respectively). Speeding was more common among drivers who crashed on Oahu (47%) or the island of Hawaii (48%), compared to those who crashed in Kauai (26%) or Maui counties (25%). Sixteen-percent of drivers crashed after failure to keep in the proper lane (20%), and 8% were described as inattentive or distracted.

Figure 41. Contributing factors among drivers involved in fatal car crashes in Hawaii, 2007-2010.



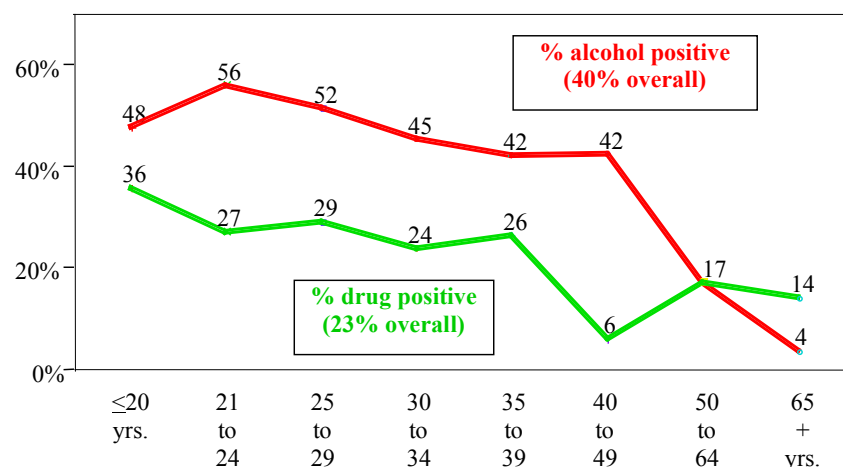
Forty percent of the 288 drivers involved in fatal car crashes tested positive for alcohol, and nearly one-fourth (23%) tested positive for drugs (Figure 42). Considered together, almost half (49%) of drivers tested positive for either alcohol or drugs. Most (89%, or 101 of 114) of the drivers who tested positive for alcohol had BAC levels of 0.08% or greater, including 66 drivers (58%) who had BAC levels of 0.16% or greater. There was no consistent trend in the annual proportion of drivers who were drinking, although this was highest in 2009 (52%), and lowest in 2010 (30%). There was no trend in the proportion of drivers who tested positive for drugs. The most commonly occurring drugs were THC (42 drivers) and stimulants (28 drivers), principally methamphetamine (12 drivers), amphetamine (6 drivers), and cocaine (13 drivers).

Figure 42. Alcohol and/or drug use (percent) among car drivers involved in fatal car crashes in Hawaii, 2007-2010.



The peak age of alcohol use among drivers was 21 to 24 years of age, as 56% (29 of 52) tested positive for alcohol (Figure 43). Alcohol use progressively decreased with increasing driver age after this peak, being lowest among senior aged drivers (4%). Underage drinking was highly prevalent in Hawaii, as nearly half (48%, or 20 of 42) of the drivers under 21 years of age had been drinking. There was also an association between driver age and positive drug tests, as the proportion generally decreased from 36% among drivers under 21 years of age to 14% among senior-aged drivers.

Figure 43. Alcohol and drug use (percent) among car drivers involved in fatal car crashes in Hawaii, by age of driver, 2007-2010.



Drivers who tested positive for alcohol and/or drugs were significantly different in a number of ways than drivers who were negative or not tested (Table 5). They were significantly younger overall, and more likely to be in the 21 to 34 year peak age range. Substance positive drivers were 3 times more likely to have not been using seat belts at the time of the crash, and 3 times more likely to have been speeding. These behaviors contributed to significantly elevated fatality rates among substance using drivers compared to other drivers. Drivers who tested positive for alcohol or drugs were also significantly more likely to have had an invalid license at the time of the crash.

There were few significant differences between drivers who tested negative for both alcohol and drugs, and drivers who were not tested for either substance. Apart from fatality rate (almost all (98%) fatally injured occupants are tested) the only exception was tested drivers were significantly more likely to have been in a weekend crash (40%), compared to untested drivers (21%), and less likely to have been in a night time crash (29%, vs. 50% of untested drivers). These findings support the assumption that there was little probable cause for testing among drivers who were not tested and they can therefore be considered to have the same sobriety status as drivers who actually tested negative.

Table 5. Characteristics of drivers involved in fatal car crashes in Hawaii, by category of substance use, 2007-2010.

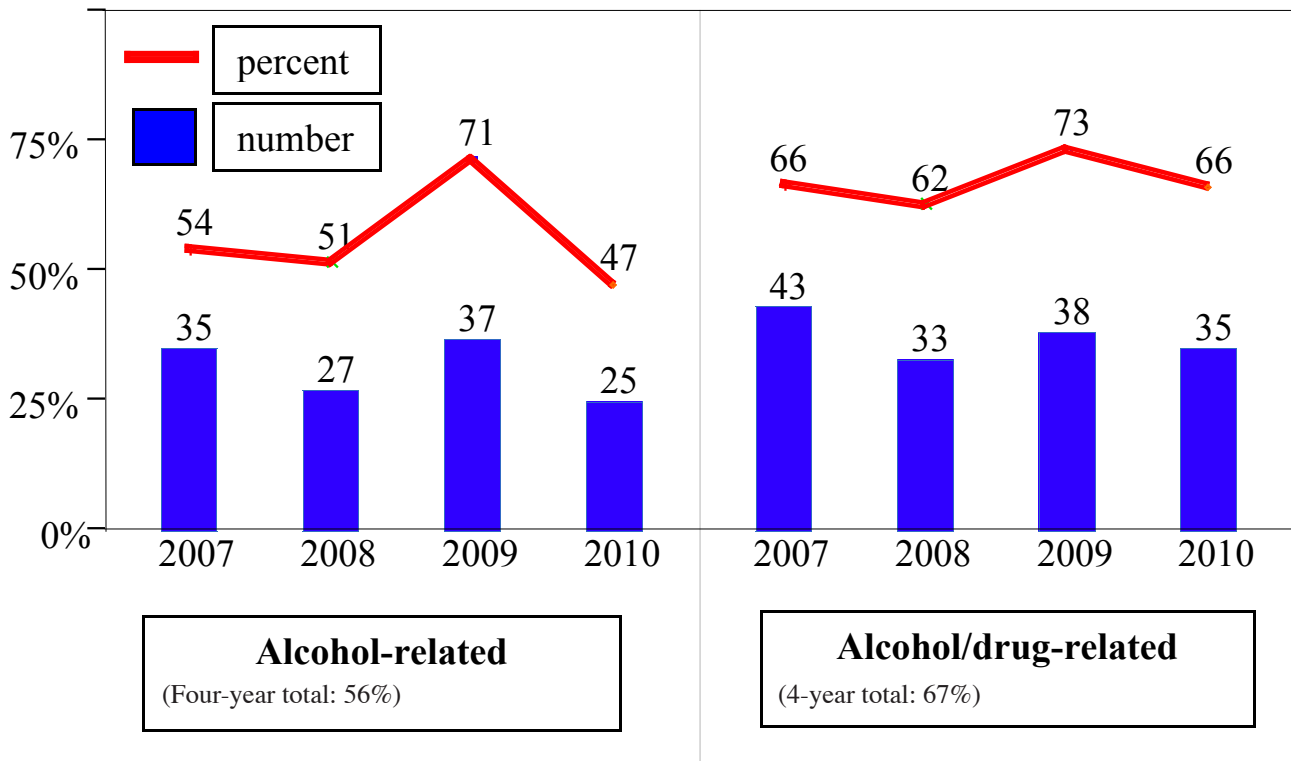
	Alcohol positive (114 drivers)	Drug positive (66 drivers)	No substances/ not tested (137 drivers)
Age			
average age	30 years*	33 years*	43 years
ages 21 to 34 years	56%*	50%*	34%
Gender (% male)	78%*	83%*	64%
Restraint use (% w/o seat belts)	70%*	55%*	18%
Speeding	71%*	58%*	19%
Previous crashes	20%*	20%	33%
Previous DUI	5%	2%	2%
Previous suspension of license	11%	10%	6%
Invalid license	22%*	29%*	11%
Fatality rate	77%*	74%*	40%
Weekend crash (Sat/Sunday)	53%*	50%*	34%
Nighttime crash (8 pm - 5 am)	82%*	62%*	36%

*Indicates statistically significant difference between alcohol/drug positive drivers and drivers negative for these substances. Drivers with "unknown" values for alcohol or drug test results were excluded (n=10). Exclusions were also made for drivers with missing or unknown values for restraint use, previous driving history.

More than half (56%, or 124) of the 223 occupant fatalities were related to alcohol consumption among at least one driver (left side of Figure 44). (All of the statistics in this section include crashes for which the alcohol status was unknown.) There was no consistent annual trend in this proportion, which varied from 47% to 71%. Each year there was an average of 31 resident occupants killed in alcohol-related crashes. Alcohol involvement was greater when only nighttime (those occurring between 7:31 pm and 5:29 am) crashes are considered: 75% (101) of the 134 fatalities were alcohol-related. The proportion of alcohol-related fatalities was highest for crashes on Hawaii (69%) and Kauai counties (64%) and lowest for crashes on Honolulu (45%) and Maui counties (49%).

If drugs were also considered, 67% of occupant fatalities were related to drivers who tested positive for either alcohol or drugs (right side of Figure 44). This proportion peaked in 2009 at 73%. Most of the occupants killed in Hawaii (84%, or 59 of 70) or Kauai counties (79%, or 22 of 28) were in alcohol/drug-related crashes. (This proportion was 52% for Honolulu County and 59% for Maui County.) Alcohol/drug-related crashes accounted for almost all (81%, or 108 of 134) of the occupants killed in nighttime crashes.

Figure 44. Annual number and percentage of substance-related deaths among car occupants in Hawaii, 2007-2010.



Figures 45 and 46 show the approximate locations of the fatal crashes within each county, and the number of occupant fatalities by district. The alcohol status for the crash is color coded, although this was not available for 67 (25%) of the 266 crashes. The districts with the 5 highest fatality totals were North Kona (22 deaths) and Puna (14) in Hawaii County, Waianae (14) on Oahu, and Wailuku (20) and Makawao (15) on Maui. All of the 9 districts on Hawaii had at least 4 deaths, including 5 districts with 11 or more deaths. Only about one-quarter (27%, or 28) of the 103 fatal crashes on Oahu were on the eastern end of the island (Figure 45).

Figure 45. Approximate location of fatal car crashes on Oahu and eastern Oahu (bottom map), by alcohol status, 2007-2011.

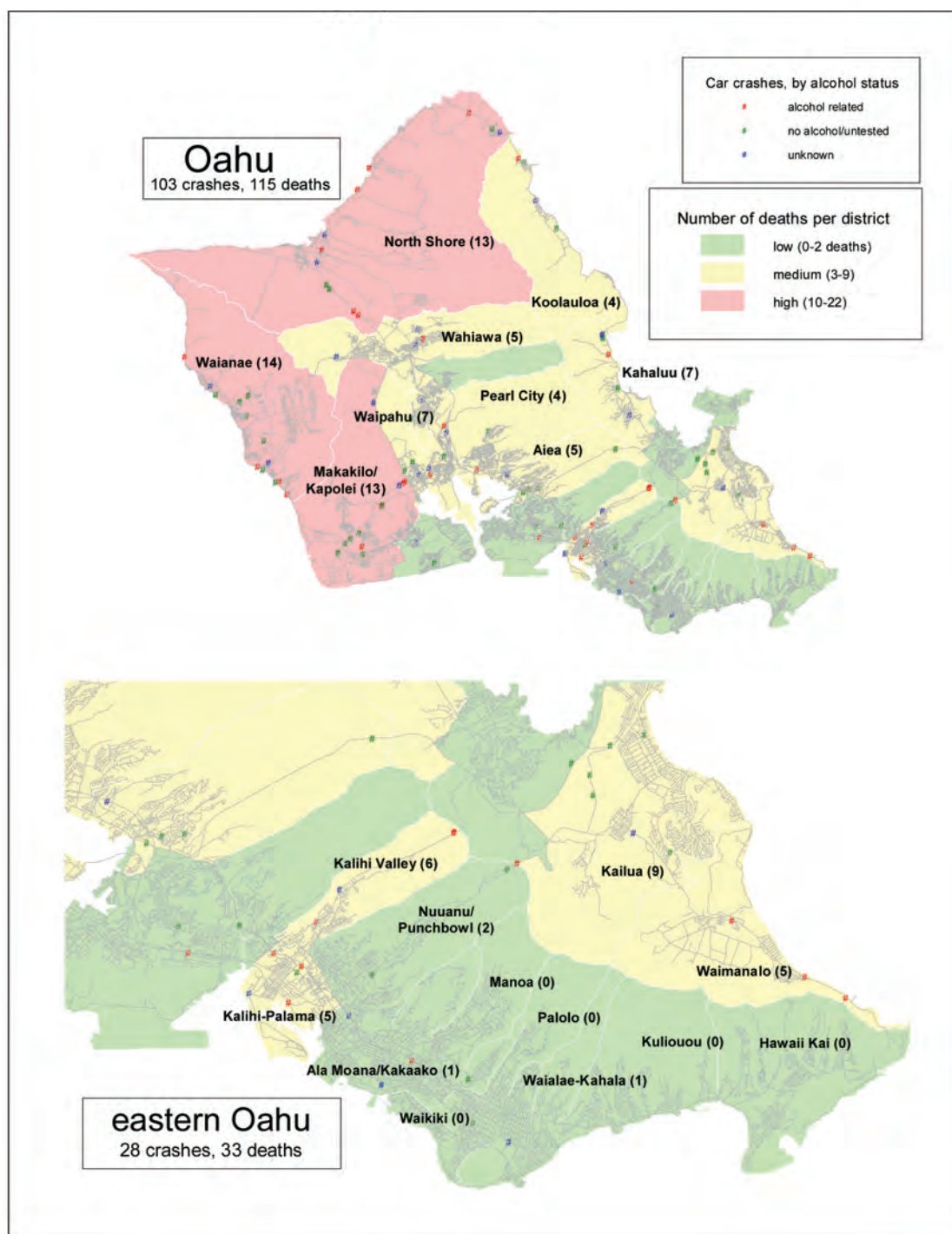
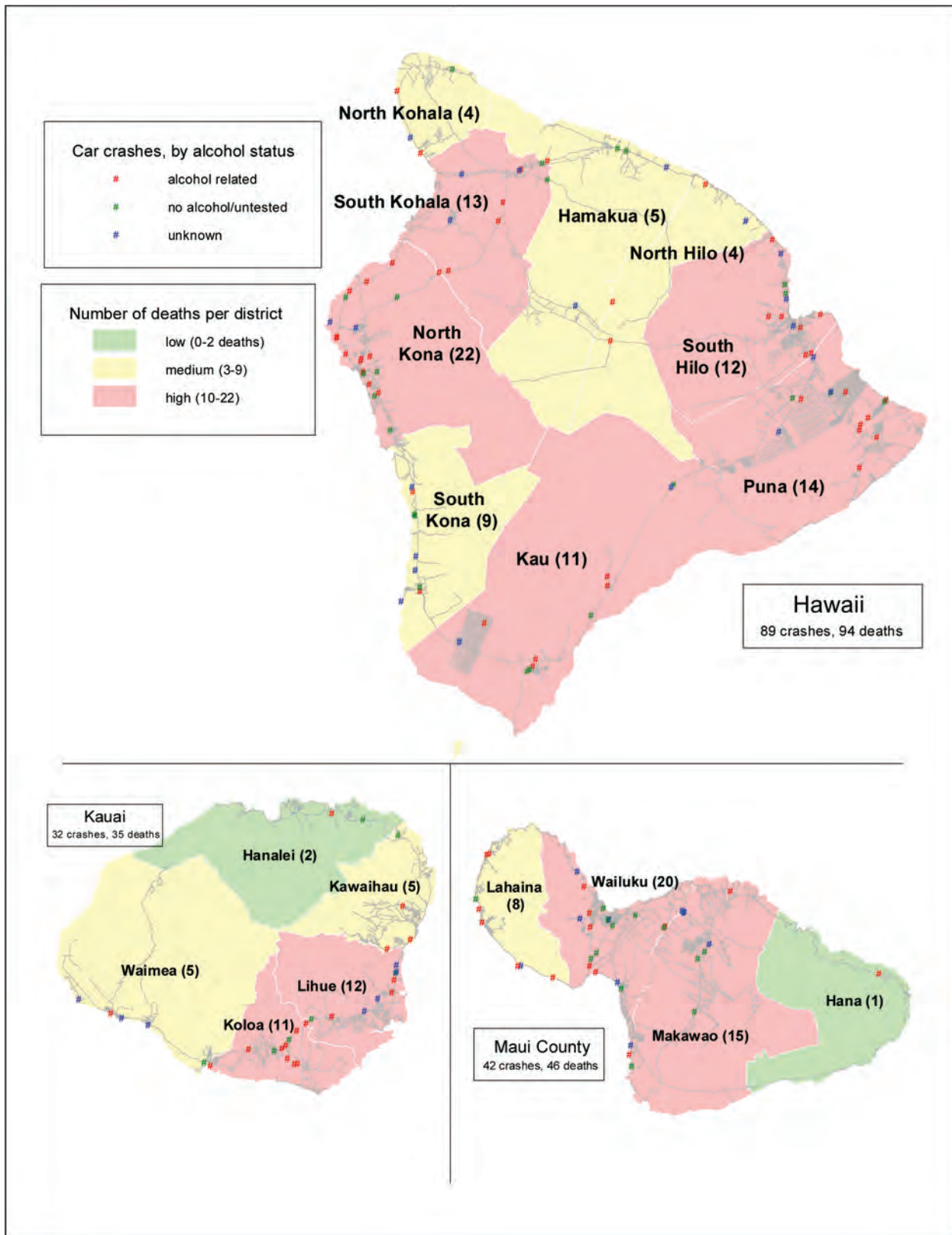


Figure 46. Approximate location of fatal car crashes on Neighbor Islands, by alcohol status, 2007-2011.



Nonfatal injuries

There were decreasing trends in the annual number of nonfatal injuries among automobile occupants, both for those treated in EDs or requiring hospitalization (Table 6). Most (91%) of the injuries were treated in EDs. Gender was nearly equally distributed (52% females, 48% males) overall, but males comprised 60% of those who were hospitalized. Patient age was widely distributed, although more than one-quarter (27%) of those who were treated in EDs or hospitalized (28%) were in the 15 to 24 year age range. Relatively few were younger than 15 (7%) or older than 65 years of age (10%). Slightly more than half (56%) of the patients were residents of Oahu, although 70% of the state's population resided on that island. In contrast, 25% of the patients were residents of Hawaii County, which comprised only 14% of the population.

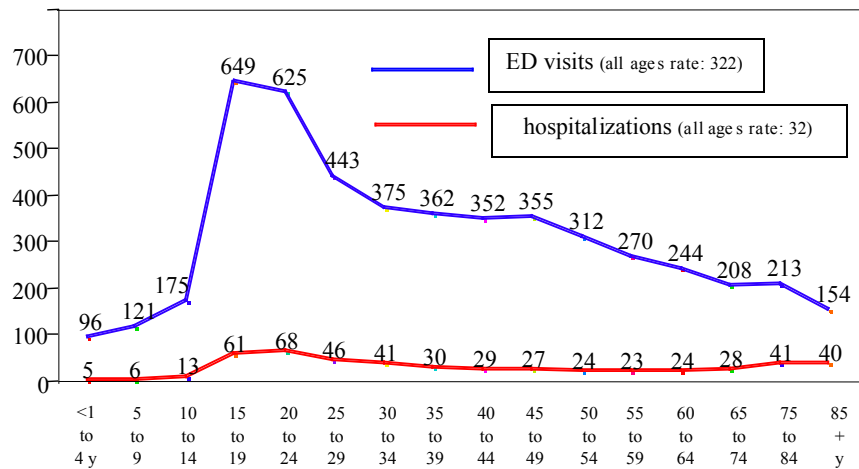
Table 6. Demographic characteristics* of Hawaii residents with nonfatal injuries from automobile crashes.

	ED visits	hospitalizations	total
Year of admission			
2007	5100	512	5612
2008	4559	470	5029
2009	3833	386	4219
2010	3742	355	4097
2011	3786	345	4131
average annual total	4204	414	4618
Patient gender			
Female	2216 (53%)	164 (40%)	164 (40%)
Male	1988 (47%)	249 (60%)	2238 (48%)
Patient age			
infants	10 (0%)	1 (0%)	11 (0%)
1-4 y	74 (2%)	16 (4%)	77 (2%)
5-14 y	231 (5%)	16 (4%)	246 (5%)
15-24 y	1118 (27%)	114 (28%)	1232 (27%)
25-34 y	766 (18%)	81 (20%)	847 (18%)
35-44 y	616 (15%)	51 (12%)	667 (14%)
45-54 y	607 (14%)	46 (11%)	653 (14%)
55-64 y	406 (10%)	37 (9%)	443 (10%)
65-74 y	189 (5%)	25 (6%)	214 (5%)
75-84 y	141 (3%)	27 (6%)	168 (4%)
85+ y	46 (1%)	12 (3%)	58 (1%)
County of residence of patient			
Hawaii	1026 (24%)	107 (26%)	1133 (25%)
Honolulu	2398 (57%)	208 (50%)	2606 (56%)
Kauai	327 (8%)	31 (8%)	358 (8%)
Maui	453 (11%)	68 (16%)	521 (11%)

*Statistics are annual averages over the 2007-2011 period.

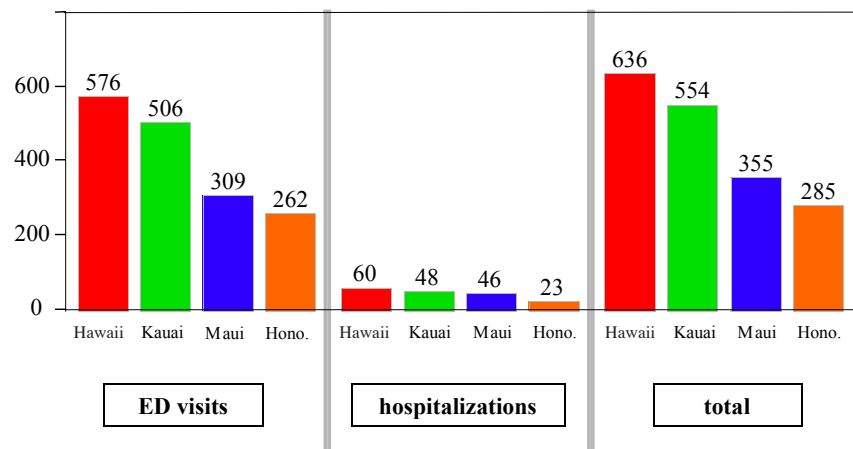
The peak age for rates of both ED visits and hospitalizations was among 15 to 24 year-old residents (Figure 47). For either type of injury the lowest rates were found for residents under 15 years of age, with lowest rates among those under 5 years. Rates of ED visits declined progressively from the peak among 15 to 19 year-olds, while hospitalizations generally declined over the 25 to 64 year age range, before increasing among older age groups.

Figure 47. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for nonfatal injuries from automobile crashes in Hawaii, by age of patient, 2007-2011.



All counties differed significantly from each other in rates of nonfatal injuries treated in EDs and all injuries combined (with the exception of ED visits for residents of Hawaii and Kauai counties), with highest rates computed for residents of Hawaii County, followed by Kauai, Maui and Honolulu counties (Figure 48). Rates of ED visits among residents of Hawaii and Kauai counties were approximately double the rate for Honolulu County residents. Residents of Honolulu County also had the lowest rates of hospitalizations, significantly lower than any other county. Hospitalization rates among Neighbor Islands were statistically comparable.

Figure 48. Age adjusted annual rates (per 100,000 residents) of nonfatal injuries from automobile crashes, by level of care and county of residence of patient, 2007-2011.



Almost all (95%) of the injuries were coded as “traffic”, or occurring on public roads. The proportion of injuries from non-traffic crashes (those on private roads, driveways and parking lots) was nearly twice as high among patients from Neighbor Islands (7%) compared to those from Oahu (4%). Three-quarters (75%) of the injuries resulted from collisions with other vehicles (68%) or other objects such as abutments or traffic signs (7%). One-fifth (20%) of the crashes did not involve collisions with other vehicles or objects on the roadway, but were due to loss of control in a single vehicle crash. (Collision status of the crash was unspecified for the remaining 5% of occupants.) Hospitalized patients were much more likely to have been injured in crashes that did not involve collisions on the roadway (40%) than were patients who were treated in EDs (18%).

Patients were hospitalized for an average of nearly 1 week, with nearly \$46,000 in average medical charges per patient (Table 7). Hospitalizations comprised most of the annual total of \$28.6 million in medical charges in the state. The average ED visit resulted in over \$2,300 in average medical charges. Most (85%) of the hospitalized patients had internal injuries (32%) or fractures (53%), which were widely distributed throughout the body. Patients who were treated in EDs were more likely to have less severe injuries such as sprains and strains (43%) or contusions and superficial injuries (29%). The incidence of traumatic brain injury was also much higher among the hospitalized patients (37%) compared to those treated in EDs (14%).

Table 7. Clinical characteristics* of Hawaii residents with nonfatal injuries from automobile crashes.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	6.5	1.5
Total number of days	4,204	2,686	6,890
Average charge	\$2,329	\$45,987	\$6,193
Total charges	\$9.79 million	\$19.02 million	\$28.60 million
Primary injury diagnosis			
fractures	248 (6%)	218 (53%)	467 (10%)
fracture of skull	29 (1%)	37 (9%)	67 (1%)
vertebral column	30 (1%)	40 (10%)	70 (2%)
ribs, pelvis or trunk	66 (2%)	52 (12%)	117 (3%)
humerus	12 (0%)	7 (2%)	20 (0%)
lower arm or hand	69 (2%)	17 (4%)	87 (2%)
femur	2 (0%)	25 (6%)	28 (1%)
lower leg or foot	39 (1%)	39 (9%)	78 (2%)
sprains and strains	1787 (43%)	5 (1%)	1792 (39%)
internal injuries	186 (4%)	132 (32%)	319 (7%)
open wounds	264 (6%)	22 (5%)	286 (6%)
contusion/superficial	1240 (29%)	14 (3%)	1254 (27%)
other/unspecified	478 (11%)	23 (6%)	501 (11%)
traumatic brain injury (any priority diagnosis)	603 (14%)	151 (37%)	754 (16%)

*Statistics are annual averages over the 2007-2011 period.

There were 25,502 EMS records for Hawaii residents who were treated by EMS personnel for occupant injuries over the 2007 to 2011 period. (Records for 478 patients whose residence could not be determined were excluded.) To avoid double-counting of injuries, the records of 300 patients who were transferred to another ambulance were excluded, resulting in the final sample of 25,202 records. Included in this total were 269 patients who ultimately died from the crashes, since this is an important outcome to examine in terms of protective factors used by occupants. (All but 5 (98%) of these 269 deaths were confirmed by linkage to death certificates.)

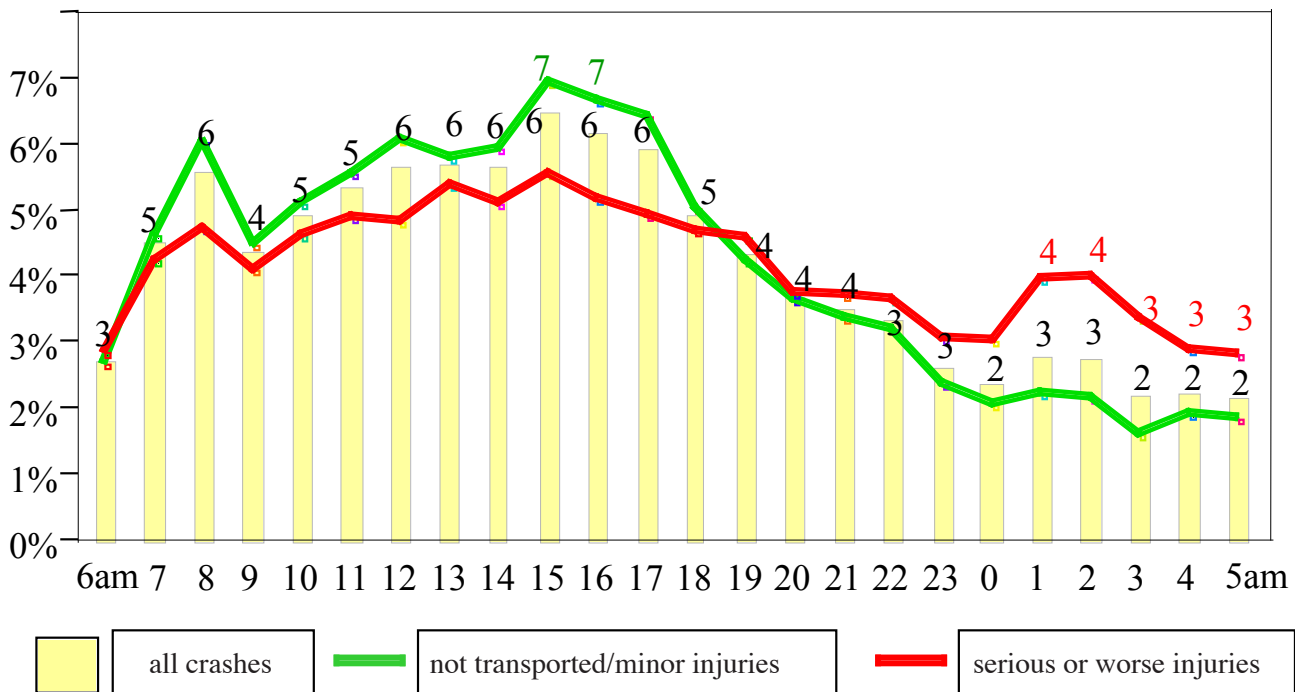
The 25,202 injuries resulted from an estimated 18,520 separate crashes. Three-fourths (75%, or 13,961) of the crashes had only a single injured occupant, 17% had 2 injuries, 5% had 3, and the remaining 3% of crashes had 4 or more injured occupants. Figure 49 shows a wide temporal distribution of these crashes, although there was a peak (19%, or 3440, of crashes) in the 3-hour period from 2:31 p.m. to 5:29 p.m. Most (72%, or 13,398) of the

crashes occurred during daytime hours (5:29 a.m. to 7:30 p.m.). That proportion was higher for crashes that did not require patient transport to hospitals or only the transport of patients with injuries of “minor” severity (76%, or 9407 of 15,822), compared to 66% (3,991) of the 9,380 crashes that involved “serious” or worse injuries. Fourteen-percent (870) of the latter type of crashes occurred between 11:31 p.m. and 3:29 a.m.

Fridays (15%, or 2770 crashes) and Saturdays (16%, or 2915) were the most common days of the week for crashes (14% for all other days). Crashes on weekends were more likely to occur during nighttime hours (37%), compared to crashes during the week (24%). One-fifth (20%, or 2634 of 13,034 crashes) of the weekday crashes occurred during the 3-hour period from 2:31 p.m. to 5:29 p.m., compared to 15% (806) of the 5486 crashes on weekends.

Figure 49. Time distribution of EMS-attended car crashes, by highest severity of injury in crash, 2007-2011.

(Horizontal scale indicates time of EMS dispatch, rounded up to nearest hour (military time scale, starting at 6:00am).
Vertical scale indicates percent of all crashes with injured occupants, rounded to nearest whole number.)



Figures 50 and 51 show the approximate locations of EMS-attended crashes within each county. The western and central portions of Oahu had the highest frequencies of crashes, although Kalihi-Palama had the highest total (841 crashes) among the 35 Neighborhood Boards. Most of the other central Honolulu areas had medium or lower totals. About half (51%) of the crashes in Hawaii County occurred in either the Hilo or North Kona districts. There was also a high total in the Puna district. About half (52%) of the crashes on the island of Maui were in the Wailuku district. There were also 88 crashes on the island of Molokai and 17 on Lanai (not shown on the Figure).

Figure 50. Number of EMS attended car crashes on Oahu and eastern Oahu (bottom map), by Neighborhood Board, 2007-2011.

(Percent of all EMS-attended crashes in the state is shown in parentheses.)

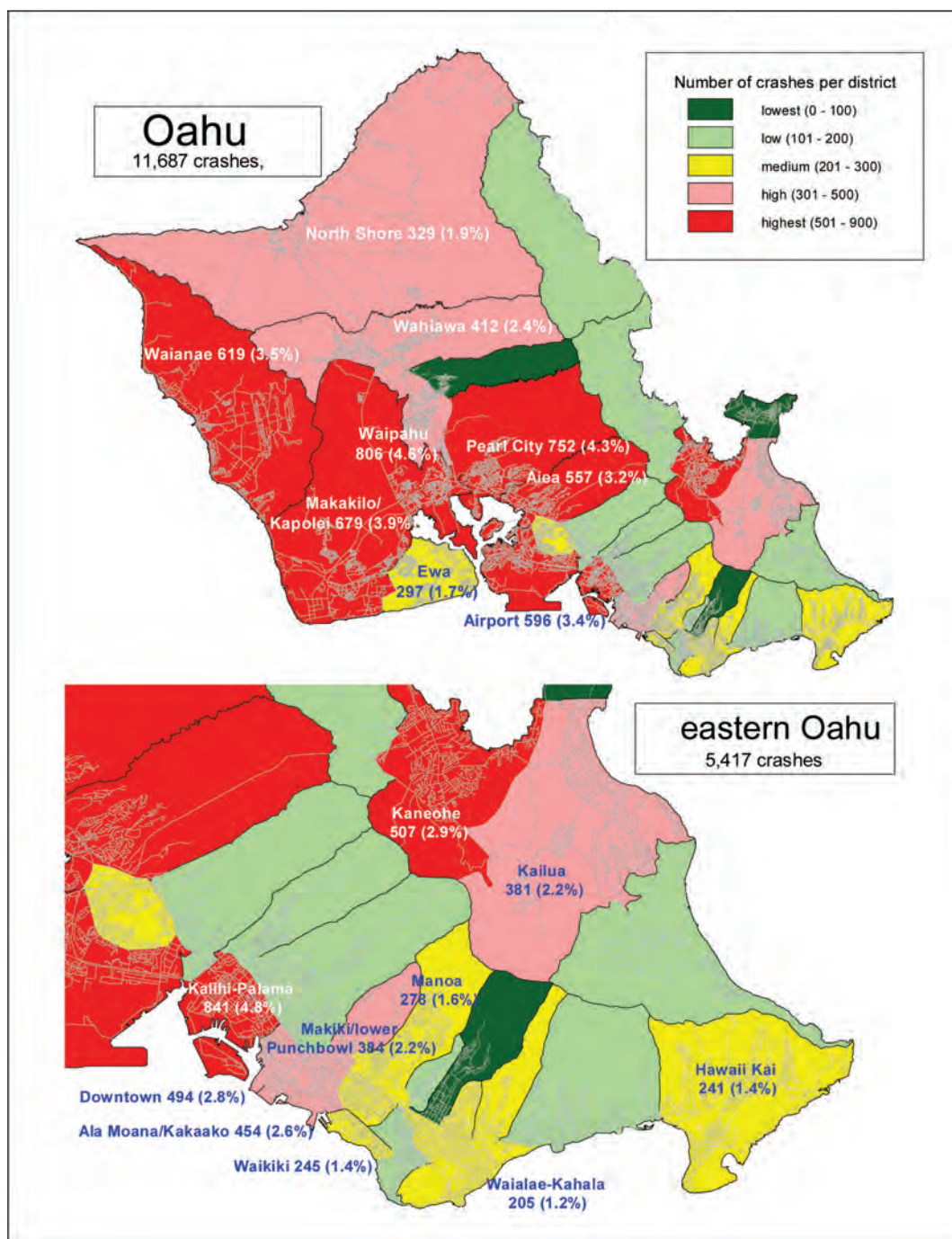
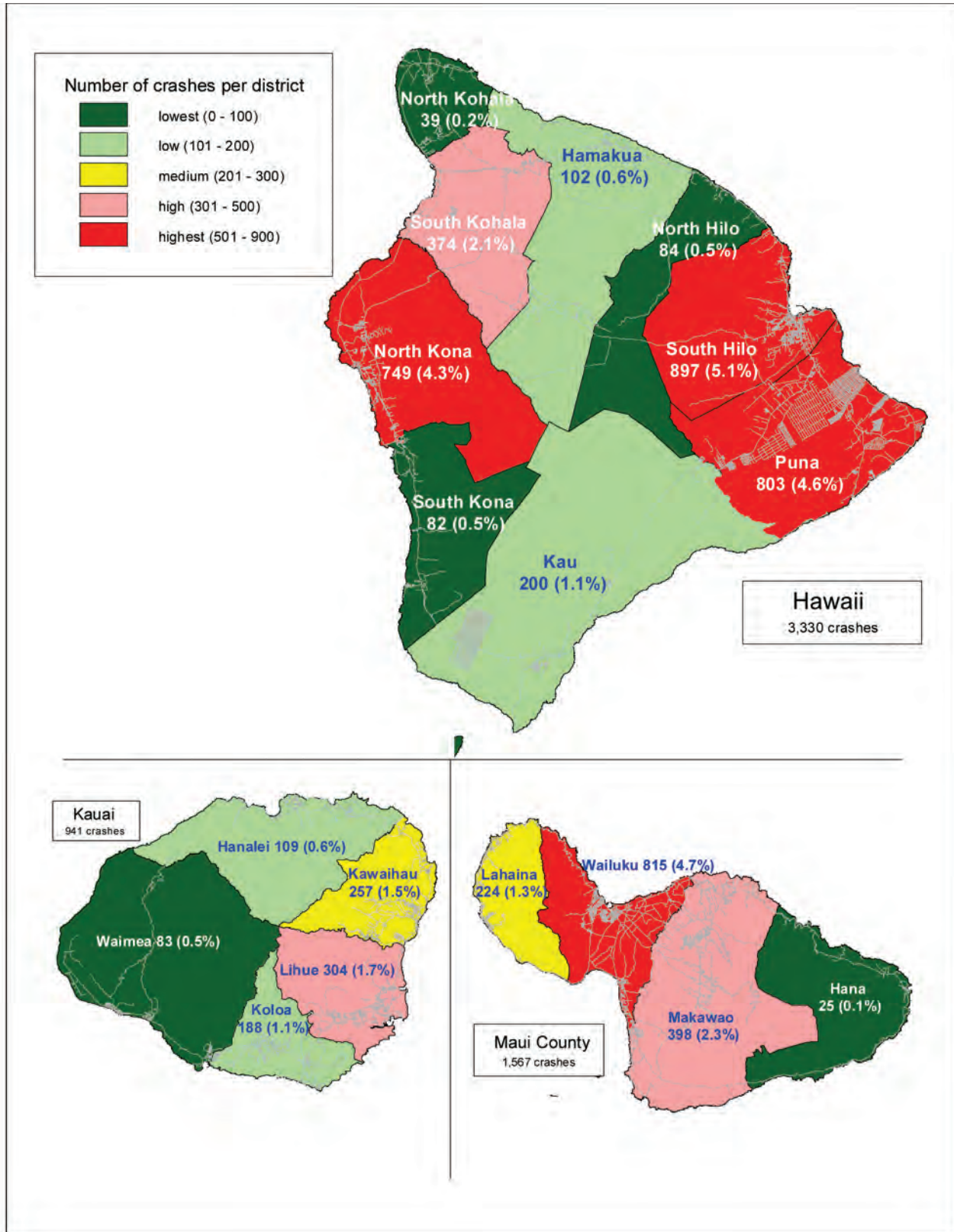


Figure 51. Number of EMS attended car crashes on Neighbor Islands, by district, 2007-2011.

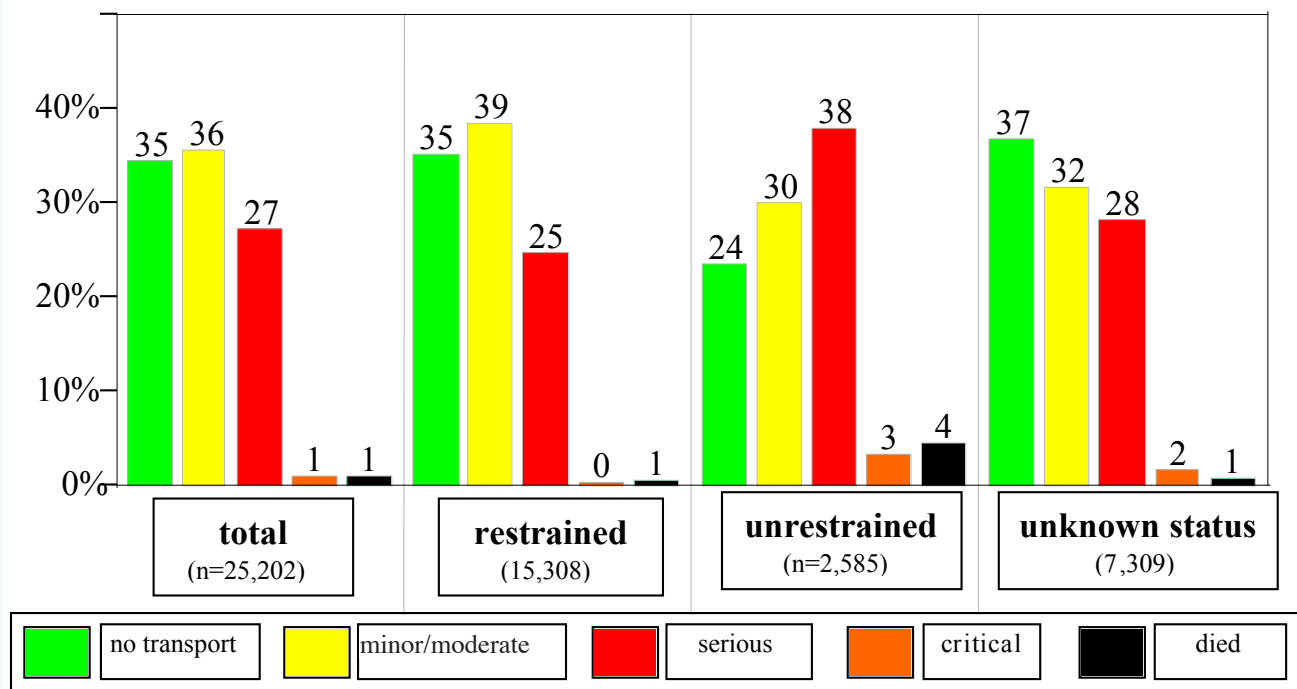
(Percent of all EMS-attended crashes in the state is shown in parentheses.)



About one-third (35%, or 8700) of the occupants refused EMS transport to hospitals and requested their release at the scene of the crash (Figure 52). A roughly equal number of patients (36%, or 8993) were transported with injuries that were characterized as “minor” or “moderate” by paramedics, and 27% were transported with “serious” injuries. There were 274 patients transported in “critical” condition, and another 269 who ultimately died. (The latter status included those described as deceased on the scene as well as those linked to death certificates after they were transported to hospitals.)

Patient condition differed by the restraint status of the occupants. Compared to restrained occupants, unrestrained occupants were more likely to have been transported with serious or critical injuries and less likely to have been released at the scene or transported with minor or moderate injuries. (All comparisons were statistically significant.) The mortality rate among unrestrained occupants (4.5%, or 116 deaths among 2585 occupants) was 7 times higher than the rate for restrained occupants (0.6%, or 97 of 15308). Use of occupant restraints was not clearly coded for 29% (7309) of these patients. The injury distribution of this group resembled that of restrained occupants more than unrestrained occupants, including a statistically comparable fatality rate with the former. This group was statistically comparable to restrained occupants in average age, probably alcohol use, and the proportion involved in night time crashes, whereas unrestrained occupants had significantly different distribution of all these variables, compared to restrained occupants.

Figure 52. Distribution of injury severity/transport status of car occupants treated by EMS personnel, by seat belt usage, 2007-2011.



*Not shown are 108 patients who were transported with injuries of unknown severity.

Probable alcohol use was noted for about 10% of the patients, as EMS personnel documented physical evidence (e.g. containers) at the crash scene, alcohol odor on the patients' breath, or the patient admitted to alcohol consumption (Table 8). Alcohol users were significantly younger than occupants who did not use alcohol or for whom this status was unknown. They were also more likely to be males, less likely to use restraints, and more likely to have been in a night time crash or a crash on the weekend. There were also significant differences in the disposition of patients, as those who had used alcohol were twice as likely to have had serious or critical injuries as other occupants, and had 5 times greater fatality rates.

Table 8. Characteristics of occupants treated by EMS personnel, by category of alcohol use, 2007-2011.

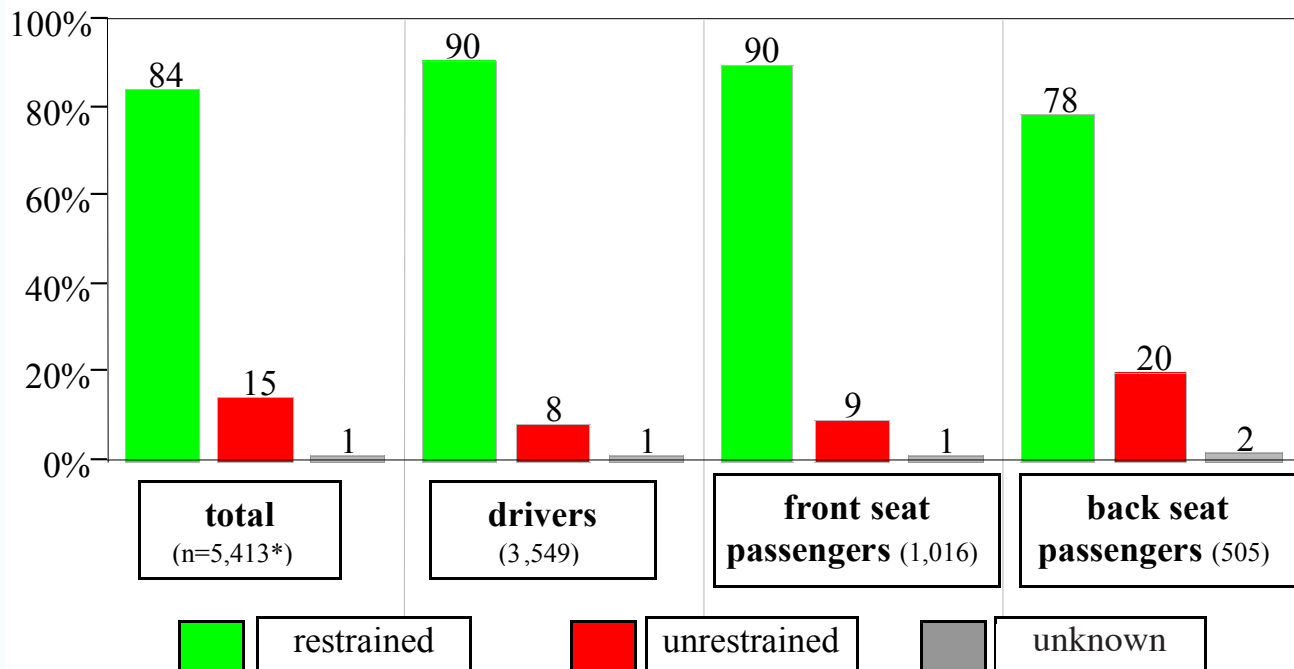
	Alcohol use (n=2,566, 10%)	No alcohol use (n=12,107, 48%)	No data/unknown (n=10,529, 42%)
Average age	32 years	39 years*	39 years*
Gender (% male)	71%	45%*	49%*
Seat belt use			
restrained	53%	74%*	48%*
not restrained	22%	10%*	8%*
unknown	25%	16%*	45%*
Disposition			
no transport	19%	36%*	37%*
minor/moderate injuries	24%	39%*	35%*
serious injuries	49%	24%*	26%*
critical injuries	3%	0.5%*	1.4%*
died	4%	0.7%*	0.8%*
Weekend crash (Sat/Sunday)	48%	28%*	29%*
Nighttime crash (8 pm - 5 am)	71%	21%*	24%*

*Indicates statistically significant difference between occupants who used alcohol vs. other occupants.

This section summarizes results from the 2007 EMS data that was linked to multiple data systems: FARS, death certificates, DOT reports, and hospital records. Since the main focus is on the mitigation of injuries by restraint usage, records for 56 patients who were seated in cargo areas or truck beds were excluded from these analyses. About three-fourths (72%, or 3895) of the 5813 remaining EMS records for injured Hawaii residents were probabilistically linked to DOT records. That proportion was highest for crashes in Hawaii (79%) and Kauai counties (77%), lowest for Maui County (63%), and intermediate for crashes on Oahu (71%). There were no significant differences in patient age or gender between linked and unlinked records. Hospital records were deterministically linked to 83% (2943) of the 3556 patients who were transported to hospitals by EMS. Hospital records were also linked to 311 additional EMS patients who refused EMS transport but apparently took private vehicles to hospitals.

Most (84%) of the occupants were wearing seat belts at the time of the crash, 15% were unrestrained, and the status was unknown for the remaining 1% (Figure 53). Only 75% of occupants who were injured in Maui County were restrained, a significantly lower proportion than for occupants injured in any other county (83% to 86%). Restraint use was significantly lower among back seat passengers (78%), compared to drivers or front seat passengers (90%). These disparities were apparent across all counties and both genders. Restraint use among back seat passenger who were under 18 years of age (87%) was significantly higher than among older passengers (68%), possibly because it is legally required among the former.

Figure 53. Restraint use among car occupants treated by EMS personnel, by seating position, 2007



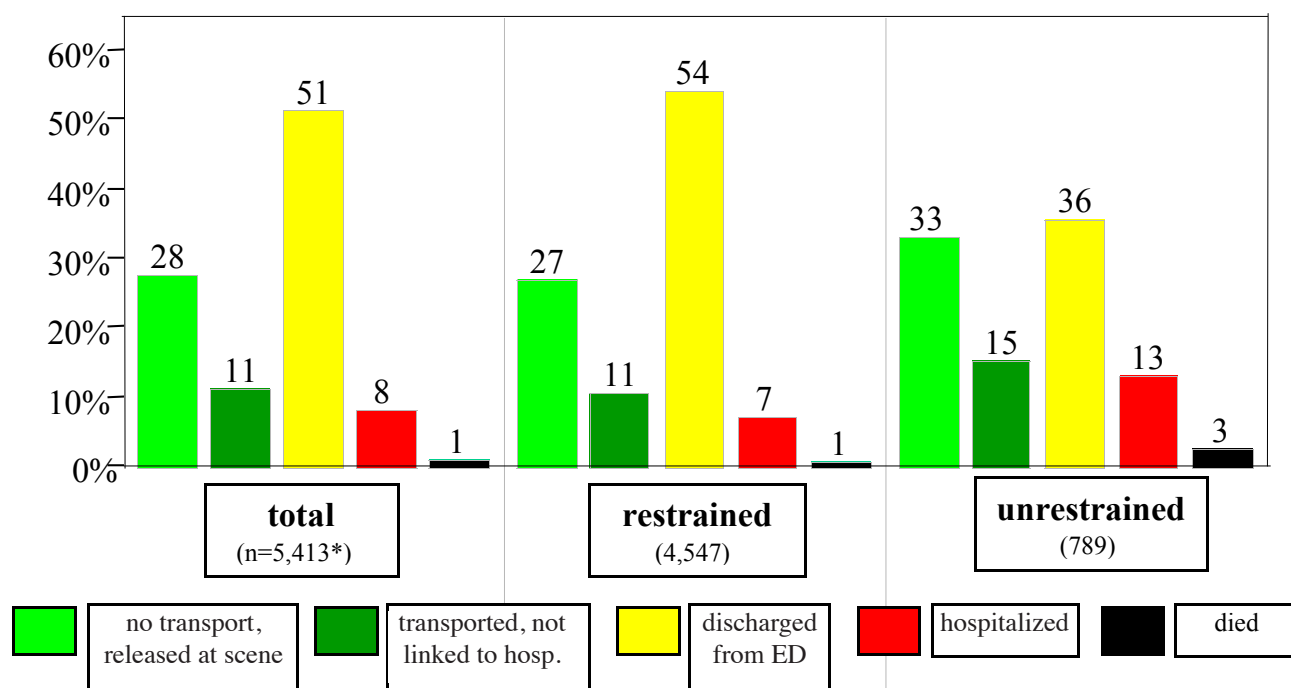
*Includes 343 patients (6% of the total) for whom seating position was not known.

Twenty-eight percent of the 5413 occupants refused EMS transport and were released at the crash scene, about half (51%) were discharged from the ED, 8% were hospitalized, and 1% (61) ultimately died from their injuries (Figure 54). The remaining 11% were transported by EMS, but could not be linked to hospital records. Paramedic characterization of injury severity for these patients (66% with “minor” injuries, 34% with “serious” or worse) was very similar to that of patients whose medical records showed a discharge from ED (68% with “minor” injuries, 32% with “serious” or worse). In contrast, most (88%) of the patients who were eventually hospitalized or who died from their injuries had “serious” or worse injuries, as graded by paramedics.

The final medical dispositions of the occupants was strongly associated with restraint usage as the proportion of unrestrained occupants who were hospitalized was nearly twice as high as among restrained occupants (13% vs. 7%), and mortality rates were 3 times among the former (2.6% vs. 0.8%).

Average medical charges were significantly higher, by 36%, among unrestrained occupants who were discharged from the ED (\$3,809), compared to restrained occupants (\$2791). There was no difference in the average charges for hospitalizations between the two groups (\$54,738 and \$53,040, respectively). The average length of each hospitalization was somewhat longer among unrestrained occupants (7.3 days, vs. 6.8 for restrained occupants), but not to a statistically significant degree.

Figure 54. Final medical disposition of car occupants treated by EMS personnel, by restraint use, 2007



* Includes 77 patients (1% of the total) for whom restraint status was not known.

Unrestrained occupants had more than twice the odds of an injury that required hospitalization or resulted in death, compared to restrained occupants (Table 9). The elevated odds were also evident after statistical adjustment for occupant age, gender, and the county in which the crash occurred. The odds of a fatal injury were more than 3 times higher among unrestrained passengers, independent of the other demographic and geographic cofactors.

Table 9. Odds ratios for adverse medical dispositions among car occupants treated by EMS personnel, by restraint use, 2007

(Odds ratio 95% confidence intervals given in parentheses.)

	Univariate model		Adjusted model*	
Restraint group	number (% of group)	odds ratios	number (% of group)	odds ratios
Odds of no transport (released at scene) or discharged from ED, vs. hospital admission or death				
restrained	362/4532 (8.0%)	1.0 (reference)	362/4496 (8.1%)	1.0 (reference)
unrestrained	123/782 (15.7%)	2.1 (1.7 – 2.7)	123/705 (17.5%)	2.3 (1.8 – 2.8)
Odds of no transport (released at scene) or transported to hospital, vs. death				
restrained	37/4532 (0.8%)	1.0 (reference)	37/4496 (0.8%)	1.0 (reference)
unrestrained	20/782 (2.6%)	3.2 (1.7 – 5.5)	20/705 (2.8%)	3.2 (1.8 – 5.6)

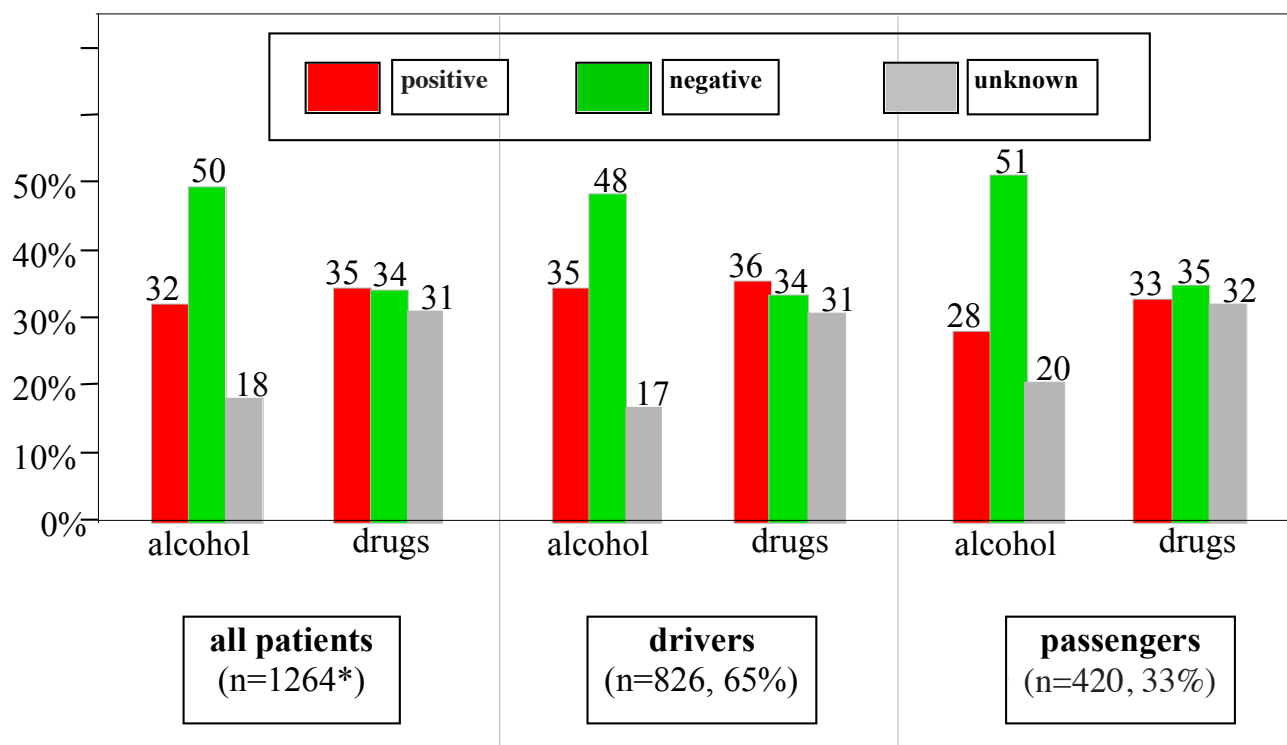
*Adjusted for occupant age, gender, and county in which crash occurred.

Trauma Registry data

About one-third of the injured resident occupants in the HTR tested positive for alcohol (32%) or illicit drugs (35%) (Figure 55). These proportions were similar between patients who were drivers and those who were passengers. Considered together, more than half (52%, or 626) of the occupants tested positive for either alcohol or drugs. Most (84%, or 240) of the 286 drivers who tested positive for alcohol had BAC levels of 0.08% or greater, including 176 drivers (62%) who had BAC levels of 0.16% or greater. The most commonly occurring drugs were narcotics (18% of patients), THC (17%), amphetamines (8%), and cocaine (4%).

Occupants who were drinking were significantly younger than those who tested negative for alcohol (32 vs. 41 years, on average), more likely to be male (75% vs. 56%), and less likely to have used seat belts (46% vs. 63%). Drinkers were also significantly more likely to have crashed on a weekend (47% vs. 33% of those who tested negative), or during night time hours (73% vs. 29%, respectively). There were no significant differences in the mortality rate or the likelihood of a discharge to a rehabilitation facility between occupants who tested positive and negative for alcohol.

Figure 55. Alcohol and/or drug use (percent) among occupants in the Hawaii Trauma Registry, by seating position, 2008-2011.



*Includes 18 patients for whom seating position was not known.

Motorcyclists

Fatal injuries

Deaths among motorcyclists were the 6th leading cause of fatal unintentional injuries in the state, accounting for 146 total deaths from 2007 to 2011. Figure 56 shows there were anywhere from 23 to 37 such fatalities each year, with no apparent trend in the annual number. The 146 fatalities resulted from 144 crashes, as only 2 crashes involved more than 1 victim. Only 5 of the victims were passengers; the rest were drivers of the motorcycle or moped. One-quarter (25%, or 37) of the victims were killed in Hawaii County, although only 14% of the population resides there and only 14% of all motorcycles are registered in this county. More than half (53%, or 77) were killed on the island of Oahu, and only 7 died on Kauai over the 5-year period.

Eighteen percent (27) of the 146 victims were killed while riding a moped (Figure 57). Most (20, or 74%) of the moped riders were killed on Oahu, which had the highest proportion of victims who were moped riders (26%, vs. 10% for the rest of the state). The number of fatally injured moped riders increased from 3 in 2007 to 8 in both 2010 and 2011.

Only about one-fourth (27%, or 40) of the decedents were wearing a helmet at the time of the crash. This proportion did not change over time or across counties, but was much lower among moped riders (7%, or 2 of 27), compared to motorcycle riders (32%, or 38 of 119).

Figure 56. Annual number of fatally injured motorcyclists in Hawaii, by county, 2007-2011.

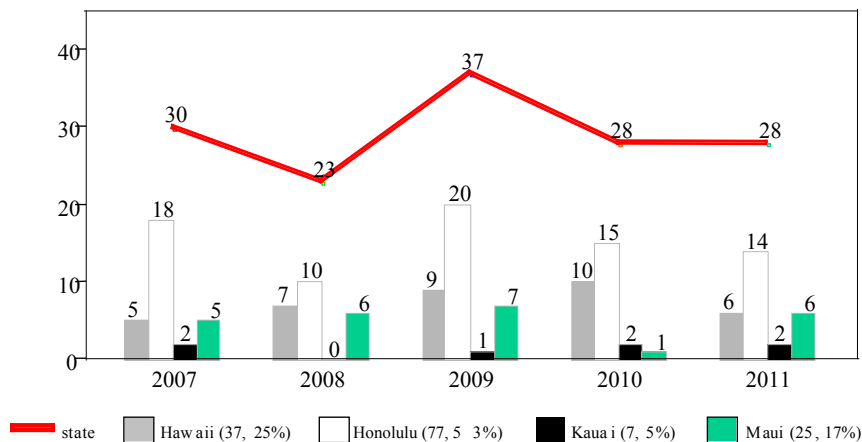
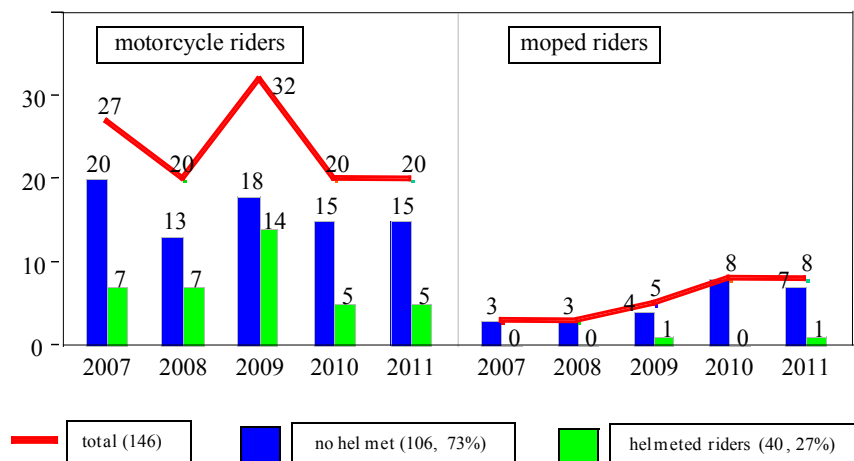
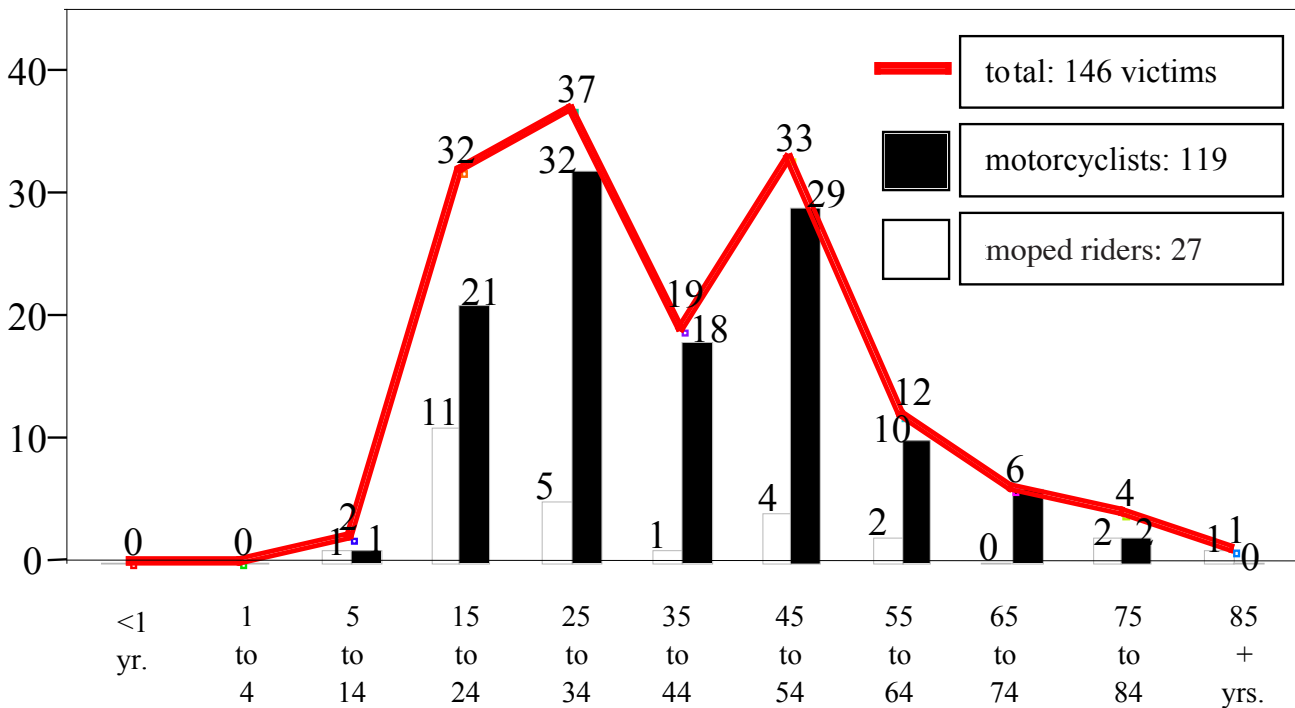


Figure 57. Annual number of fatally injured motorcyclists, by type of vehicle and helmet usage, 2007-2011.



Most of the victims were young to middle-aged adults; 79% (116) were between the ages of 20 and 55 years (Figure 58). Only 8 of the victims were younger than 18 years of age. The peak age was 20 to 34 years, which included 41% (60) of the victims. The age distributions were similar between moped and motorcycle riders. Only 9 (6%) of the victims were females, including the 4 of the 5 victims who were passengers.

Figure 58. Age distribution of fatally injured motorcyclists in Hawaii, by vehicle type, 2007-2011.



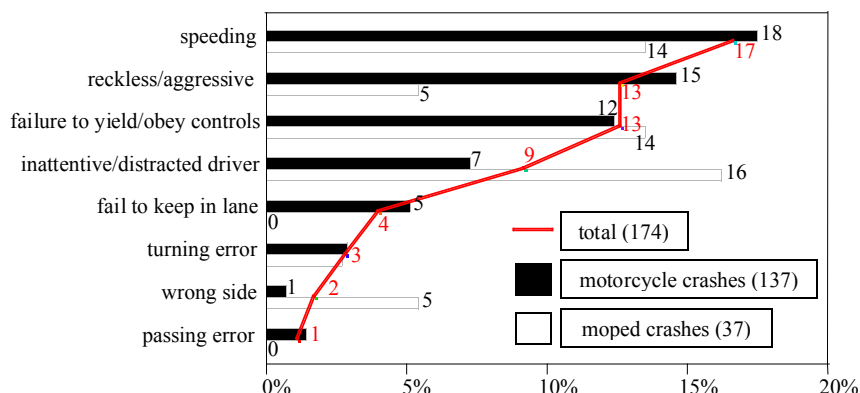
There was no noticeable seasonality in terms of the month of the year for the 144 crashes. Saturdays (24 crashes, 17% of the total) and Sundays (34 crashes) were the most common days for fatal crashes. Nearly half (43%, or 62) of the 144 crashes occurred during nighttime hours (7:30 p.m. to 5:29 a.m.), including 51 (35%) during the 6-hour period of from 7:30 p.m. to 1:29 a.m.

Most (93%, or 110) of the 118 fatalities from 2007 through 2010 could be linked to FARS records, which contain information on the involvement of alcohol, helmet use and other risk factors in the crash. This data was available both for the crash decedents and other survivors involved in the crash. The remainder of this chapter (excluding the maps) utilizes FARS data, and is therefore restricted to the 110 victims who died in traffic crashes (i.e. those that occurred on public roadways).

Almost half (46%, or 50) of the 108 crashes involved only a single moped or motorcycle, and were likely related to the driver losing control of the motorcycle. The proportion of single vehicle crashes was lower (26%) among the 19 crashes involving mopeds, and 51% for the 89 crashes involving motorcycles.

There were 174 drivers involved in the 108 fatal crashes, including 99 motorcycle drivers, 16 moped riders, 57 car/truck drivers, and 2 drivers of unknown types of vehicles. Speeding was the most common contributing factor among all drivers (17%, or 29 drivers), or drivers of either type of crash (Figure 59). Failure to yield the right-of-way or to obey traffic signs or controls was also a common factor among drivers of both types of crashes. Reckless/aggressive driving was a common factor among drivers involved in fatal motorcyclist crashes (15%), while inattentive/distracted driving was more common among those involved in moped crashes (16%).

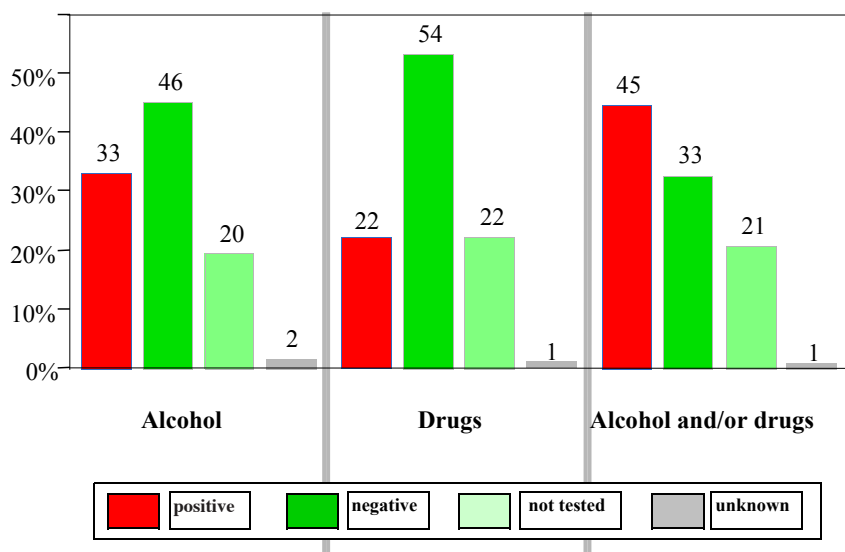
Figure 59. Contributing factors among drivers involved in fatal motorcycle/moped traffic crashes in Hawaii, by crash type, 2007-2010.



Three-fourths (76%, or 38) of the 50 single vehicle crashes involved speeding. Drivers who were speeding were significantly younger than those who were not (35 vs. 40 years), and more likely to have been in a nighttime crash (56%, vs. 33% of those who were not speeding). . Most (68%) of the 57 crashes on Oahu involved a speeding driver; speeding was a less commonly noted factor in Neighbor Islands crashes (47%, or 24 of 51).

One-third of the 174 drivers involved in fatal motorcyclist crashes tested positive for alcohol, and more than one-fifth (22%) tested positive for drugs (Figure 60). Nearly one-half (45%) of the drivers were positive for either alcohol or drugs. Most (82%, or 47 of 57) of the drivers who tested positive for alcohol had BAC levels of 0.08% or greater, and 56% (32 drivers) had BAC levels of 0.16% or greater. There was an increasing trend in the annual proportion of drivers who were drinking, from 30% in 2007 to 36% in 2010. Drivers involved in crashes on Hawaii County were most likely to have been drinking (42%, vs. 29% to 30% for other counties). There was no trend in the proportion of drivers who tested positive for drugs, although this was highest in 2010 (38%, vs. 17% to 18% in earlier years). The most commonly occurring drugs were THC (25 drivers) and stimulants (11 drivers), principally methamphetamine (7 drivers).

Figure 60. Alcohol and/or drug use (percent) among drivers involved in fatal motorcycle crashes in Hawaii, 2007-2010.



Motorcycle and moped drivers who tested positive for alcohol were significantly more likely to have been speeding, in a single vehicle crash, or been in a nighttime crash, compared to drivers who either tested negative for alcohol or drugs or who were untested (Table 10). Alcohol positive drivers were also significantly more likely to have had a previous DUI, a previously suspended license, and less likely to have had a valid motorcycle driver license. Drug positive drivers were also significantly more likely to have had a previous DUI or to have not had a valid license.

Overall, only 49% (52) of the 106 fatally injured motorcycle or moped drivers had a valid motorcycle drivers license at the time of the crash. That proportion was lower among the moped drivers (33%, or 5 of 15), compared to the motorcycle drivers (52%, or 47 of 91), although not to a statistically significant degree. Among the 54 drivers with invalid licenses, about half (52%, or 28) had a general drivers license, but not specific to operating a motorcycle. Another 14 (26%) had licenses that were suspended or revoked, 3 (6%) had expired, and 8 (15%) had no license at all.

Table 10. Characteristics of motorcycle drivers killed in crashes in Hawaii, by category of substance use, 2007-2010.

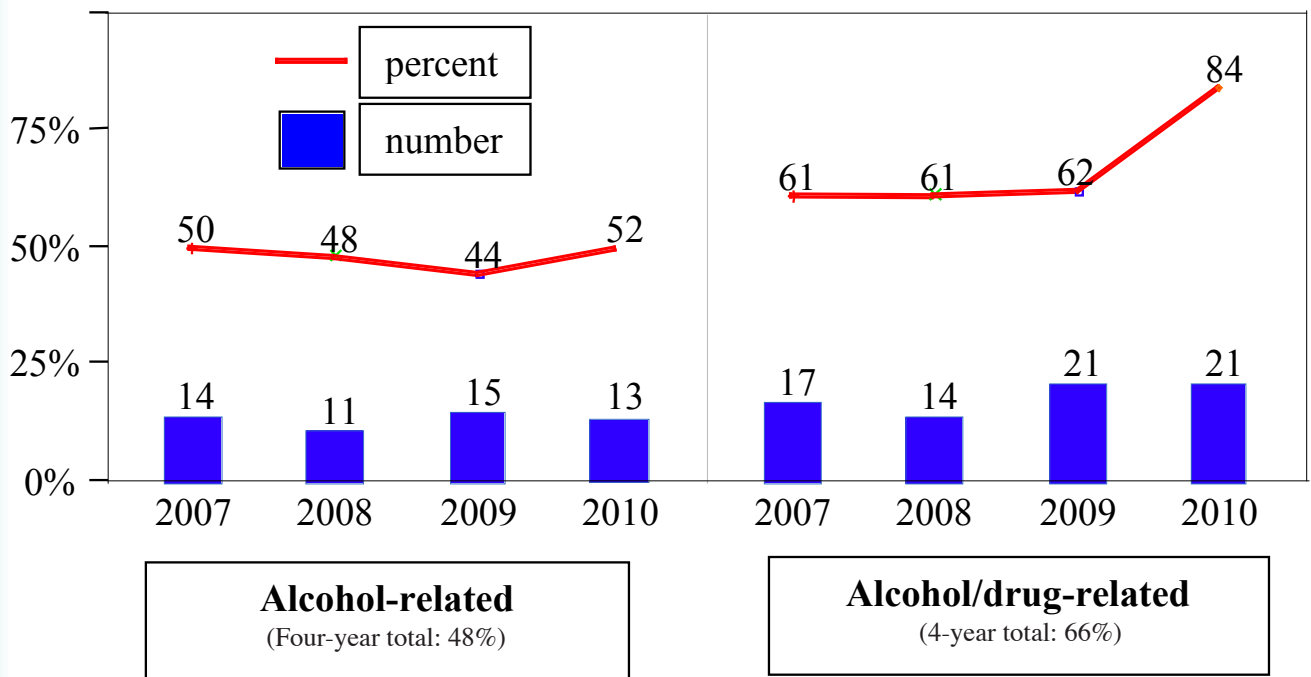
	Alcohol positive (50 drivers)	Drug positive (31 drivers)	No substances/ not tested (39 drivers)
Average age	38 years	39 years	36 years
Gender (% male)	95%	100%	95%
Helmet use	26%	16%*	41%
Speeding	72%*	55%	46%
Previous DUI	24%*	10%	3%
Previous suspension of license	31%*	16%	11%
Previous crashes	27%	35%	39%
Invalid license	58%*	52%	38%
Single vehicle crash	68%*	52%*	21%
Weekend crash (Sat/Sunday)	42%	45%	41%
Nighttime crash (8 pm - 5 am)	67%*	45%	26%

*Indicates statistically significant difference between alcohol/drug positive drivers and drivers negative for these substances. Drivers with “unknown” values for alcohol or drug test results were excluded (n=2). Exclusions were also made for drivers with missing or unknown values for restraint use, previous driving history.

Nearly half (48%, or 53) of the 110 decedents died in alcohol-related crashes (Figure 61). There was somewhat of a decreasing trend in the proportion of fatal motorcycle crashes that involved alcohol over the 2007 to 2009 period, but a subsequent increase to 52% in 2010. Most (92%, or 48) of the 52 crashes that were alcohol related involved drinking only on the part of the fatally injured motorcycle driver. (Or the motorcycle driver in the case of 1 fatally injured passenger.) Another 4 crashes involved drinking on the part of both the motorcyclists and drivers of other motor vehicles. Only 2 of the crashes involved drinking on the part of the car driver and not the motorcycle driver. The proportion of alcohol-related fatalities was highest for crashes in Hawaii County (57%). Alcohol was involved in 69% of the 51 crashes that occurred during nighttime (between 7:31 pm and 5:29 am).

If drugs were also considered, two-thirds (66%) of all fatal crashes were related to drivers who tested positive for either alcohol or drugs. This proportion increased to 84% in 2010, due mostly to crashes in Honolulu County, 12 of 13 of which were related to substance use among drivers. Nearly all (86%, or 44) of the 51 nighttime crashes involved substance use by at least one driver in the crash

Figure 61. Annual number and percentage of substance-related deaths among motorcycle and moped riders in Hawaii, 2007-2010.



Figures 62 and 63 show the approximate geographic location of the fatal motorcycle crashes. There were 13 deaths in the North Shore district, and 7 in both the Kailua and Waipahu districts (Figure 62). On Maui there were 17 deaths in the Wailuku district, and 5 in Makawao (Figure 63). There were also high numbers of deaths in the Hawaii County districts of North Kona (12), Puna (10) and South Hilo (6). The fatal moped crashes were widely distributed; South Hilo had the highest total (3 deaths).

Figure 62. Approximate location of fatal motorcycle/moped crashes on Oahu and eastern Oahu (bottom map), by alcohol status, 2007-2011.

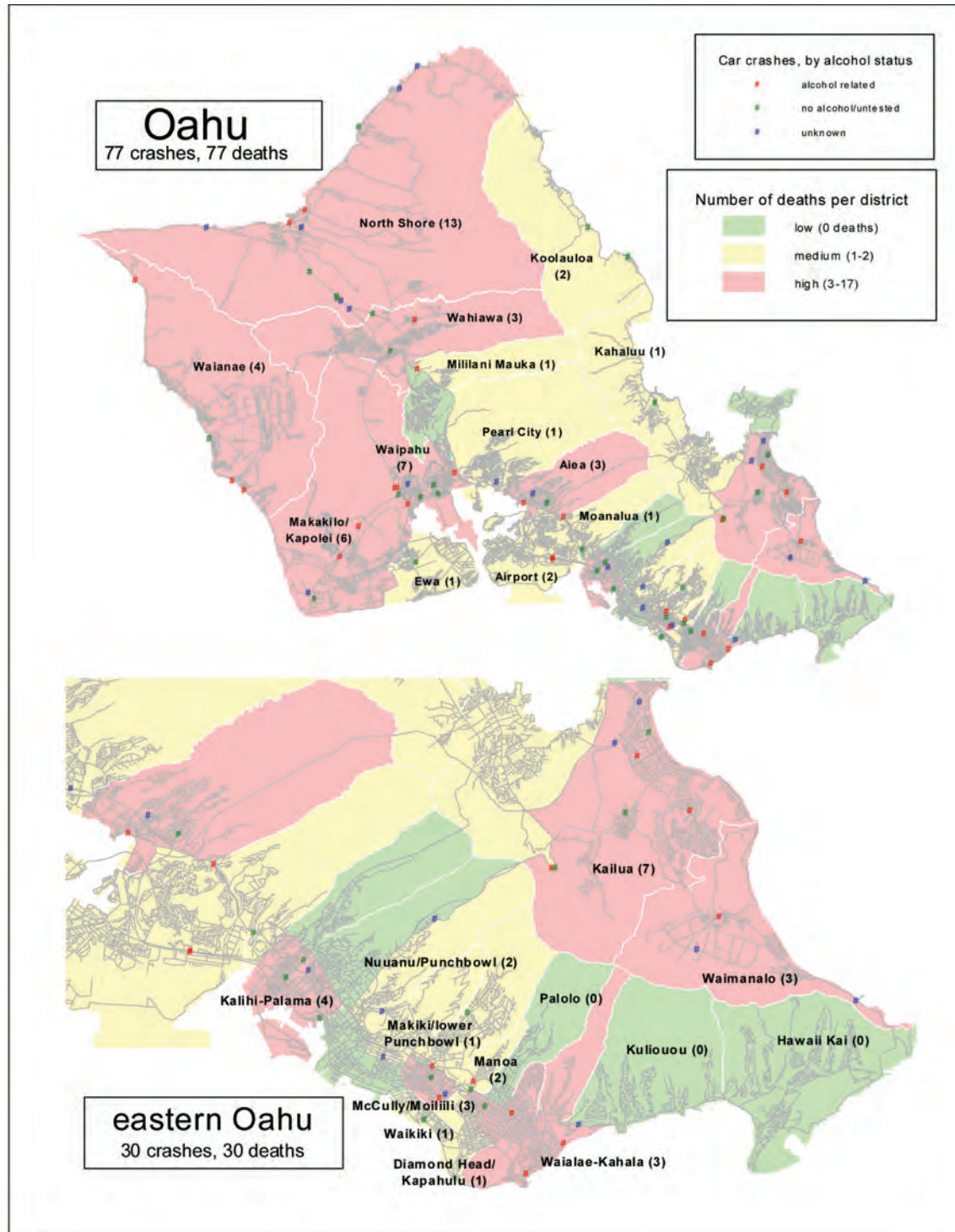
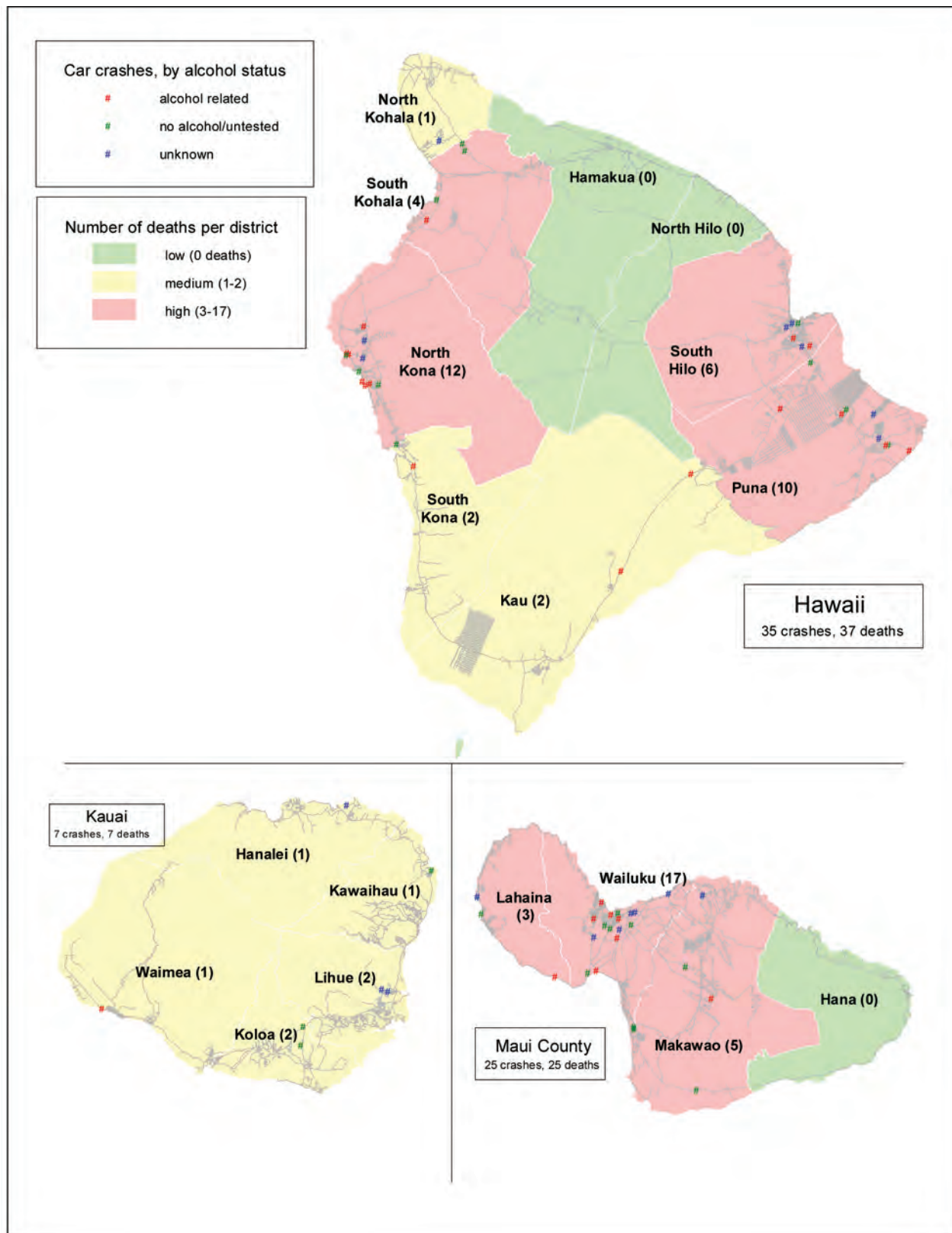


Figure 63. Approximate location of fatal car motorcycle/moped crashes on Neighbor Islands, by alcohol status, 2007-2011.



Nonfatal injuries

There was an decreasing trend in the annual number of nonfatal injuries among both motorcyclists treated in EDs and those admitted to hospitals over the 2007-2010 period, but increases in 2011 (Table 11). Hospitalizations comprised about one-fifth (21%) of the nonfatal injuries to motorcyclists. Most (83%) of the patients were males, and this distribution was consistent across counties. Patient age was narrowly distributed, as about half (51%) were 15 to 34 years of age, and most (82%) were between 15 and 54 years of age. About half (54%) of the patients were residents of Oahu. Almost all (94%) of the patients were motorcycle drivers; only 6% were passengers.

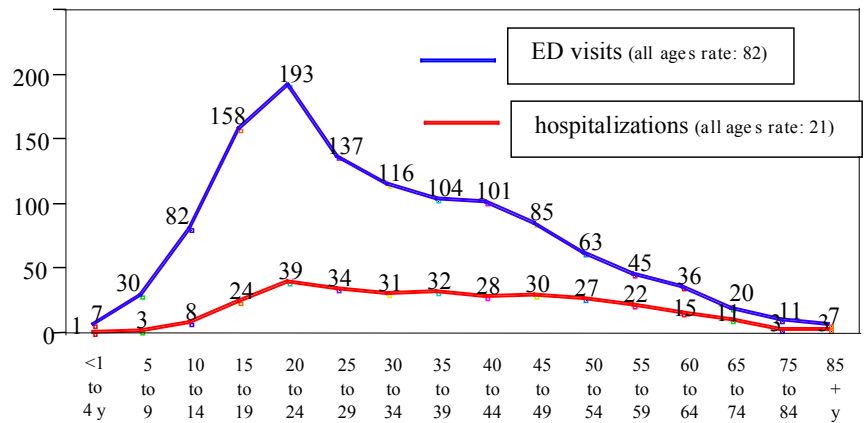
Table 11. Demographic characteristics* of Hawaii residents with nonfatal injuries from motorcycle crashes.

	ED visits	hospitalizations	total
Year of admission			
2007	1125	309	1434
2008	1049	276	1325
2009	990	257	1247
2010	964	274	1238
2011	1092	263	1355
average annual total	1044	276	1320
Patient gender			
Female	187 (18%)	36 (13%)	223 (17%)
Male	857 (82%)	240 (87%)	1097 (83%)
Patient age			
infants	1 (0%)	0 (0%)	1 (0%)
1-4 y	6 (1%)	1 (0%)	7 (1%)
5-14 y	87 (8%)	9 (3%)	95 (7%)
15-24 y	311 (30%)	58 (21%)	368 (28%)
25-34 y	238 (23%)	61 (22%)	299 (23%)
35-44 y	177 (17%)	53 (19%)	230 (17%)
45-54 y	134 (13%)	52 (19%)	185 (14%)
55-64 y	65 (6%)	30 (11%)	95 (7%)
65-74 y	18 (2%)	10 (4%)	29 (2%)
75-84 y	7 (1%)	2 (1%)	8 (1%)
85+ y	2 (0%)	1 (0%)	3 (0%)
County of residence of patient			
Hawaii	218 (21%)	47 (17%)	265 (20%)
Honolulu	552 (53%)	161 (58%)	713 (54%)
Kauai	89 (8%)	17 (6%)	106 (8%)
Maui	185 (18%)	51 (18%)	236 (18%)

*Statistics are annual averages over the 2007-2011 period.

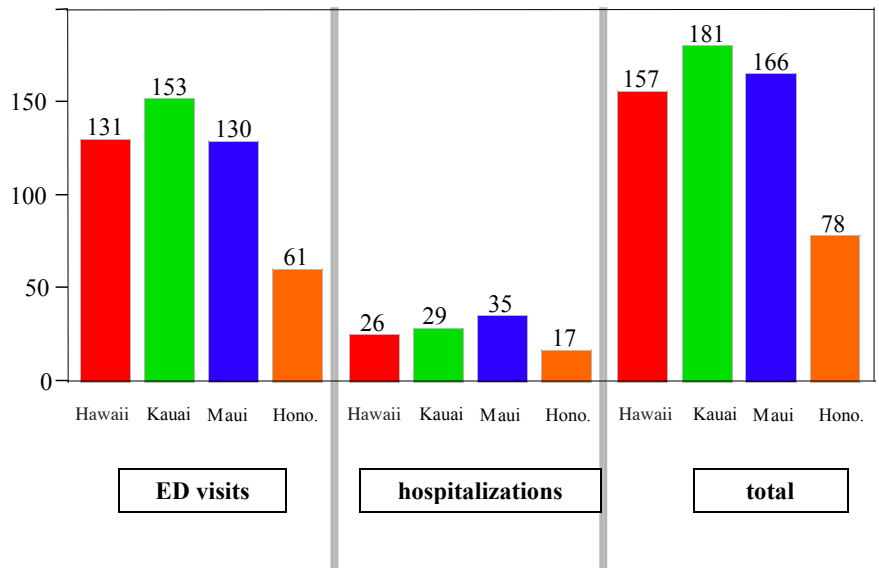
The peak age for rates of both ED visits and hospitalizations was among 15 to 29 year-old residents, particularly 20 to 24 year-olds (Figure 64). Rates of either type of injury declined steadily from the 20 to 24 year-old peak, more sharply in the case of ED visits.

Figure 64. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for nonfatal injuries from motorcycle crashes in Hawaii, by age of patient, 2007-2011.



The rate of ED visits for residents of Honolulu County was significantly lower, by at least 2 times, than the rate for residents of any other county (Figure 65). Rates were statistically comparable among the other 3 counties. A similar pattern was seen for hospitalization rates, although there was no significant difference between the rates for Kauai and Honolulu residents. The highest rate of hospitalizations was computed for Maui County residents, although they were statistically comparable to the rates for residents of Hawaii and Kauai counties.

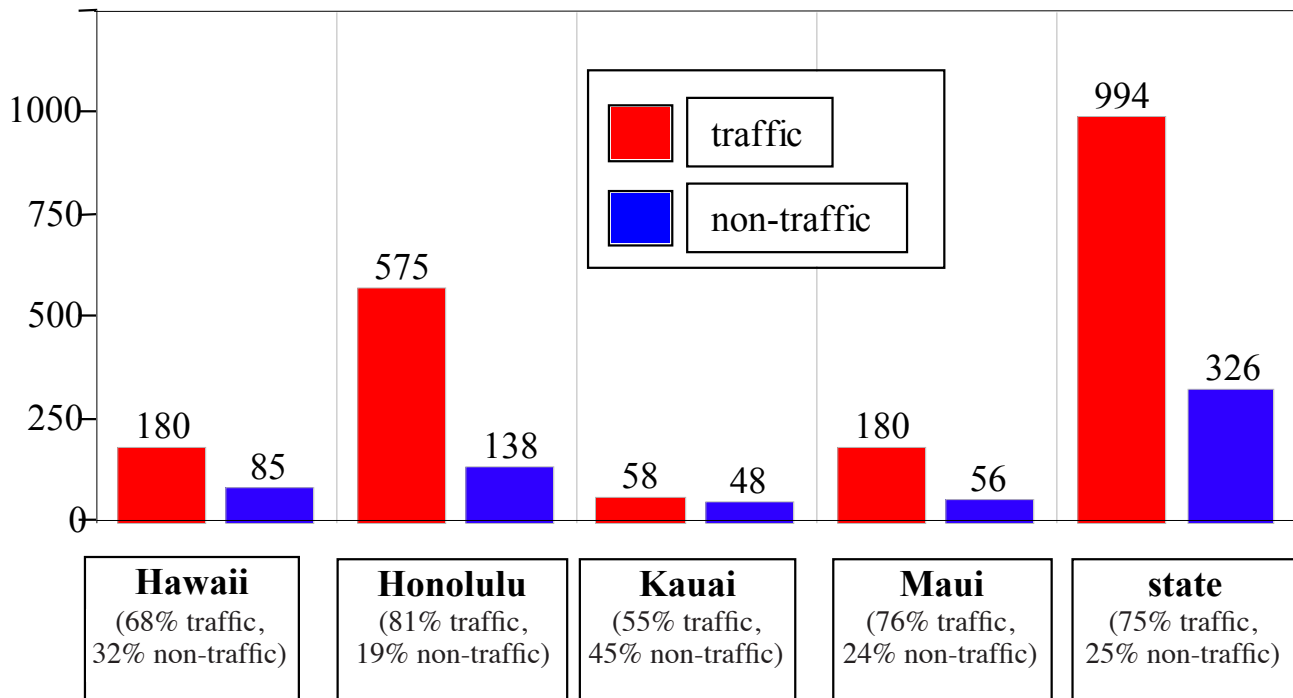
Figure 65. Age adjusted annual rates (per 100,000 residents) of nonfatal injuries from motorcycle crashes, by level of care and county of residence of patient, 2007-2011.



Only about half (46%) of the injuries resulted from crashes that involved a collision, most commonly another motor vehicle (39%). Forty-four percent of the crashes did not involve a collision, but were due to loss of control by the rider. (This status was not known for the remaining 10% of crashes.) The distribution of crash type was similar for injuries treated in EDs and those that required hospitalization.

Three-fourths (75%) of the nonfatal injuries were coded as “traffic” related, or occurring on a public roadway, while 25% were in “non-traffic” environments, including private roads, driveways and parking lots (Figure 66). The proportion of traffic crashes varied by the county of residence of the patients, being highest for residents of Honolulu (81%) and Maui (76%) counties, and lowest for residents of Hawaii (68%) and Kauai (55%) counties. Injuries that required hospitalization were significantly more likely to be from traffic crashes, compared to those that were treated in EDs (89% vs. 72%, respectively). Patients who were injured from non-traffic crashes were significantly younger on average than those involved in traffic crashes (28 vs. 35 years, respectively). Nearly one-fifth (19%) of the patients who were injured in non-traffic crashes were 5 to 14 years of age, compared to only 3% of those who were injured in traffic crashes.

Figure 66. Average annual number of nonfatal injuries from motorcycle crashes in Hawaii, by type of crash and county of residence of patient, 2007-2011.



Because patients were hospitalized for an average of 1 week, the total number of days of care was greater for hospitalizations than ED visits (Table 12). Hospitalizations also comprised most (85%) of the annual total of \$16.7 million in medical charges in the state. The average hospitalization resulted in over \$51,000 in medical charges, compared to about \$2,700 for each ED visit.

Nearly two-thirds (64%) of the hospitalized patients and one-quarter (23%) of those treated in EDs had fractures, most commonly in the lower leg or foot, although fractures were widely distributed among areas of the body. Internal injuries were also prevalent (24%) among hospitalized patients, while open wounds (15%) and contusions and superficial injuries (31%) were more common among those treated in EDs. One-fifth (21%) of the patients had a traumatic brain injury, including 39% of those who were hospitalized.

Table 12. Clinical characteristics* of Hawaii residents with nonfatal injuries from motorcycle crashes.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	7.2	2.3
Total number of days	1,044	1,980	3,024
Average charge	\$2,725	\$51,626	\$12,625
Total charges	\$2.8 million	\$14.2 million	\$16.7 million
Primary injury diagnosis			
fractures	245 (23%)	178 (64%)	423 (32%)
fracture of skull	12 (1%)	35 (13%)	48 (4%)
vertebral column	8 (1%)	12 (4%)	20 (2%)
ribs, pelvis or trunk	80 (8%)	26 (9%)	106 (8%)
humerus	13 (1%)	6 (2%)	19 (1%)
lower arm or hand	70 (7%)	14 (5%)	85 (6%)
femur	2 (0%)	26 (9%)	28 (2%)
lower leg or foot	60 (6%)	58 (21%)	117 (9%)
sprains and strains	124 (12%)	2 (1%)	126 (10%)
internal injuries	64 (6%)	66 (24%)	130 (10%)
open wounds	153 (15%)	16 (6%)	169 (13%)
contusion/superficial	323 (31%)	3 (1%)	326 (25%)
other/unspecified	135 (13%)	12 (4%)	146 (11%)
traumatic brain injury (any priority diagnosis)	172 (16%)	108 (39%)	280 (21%)

*Statistics are annual averages over the 2007-2011 period.

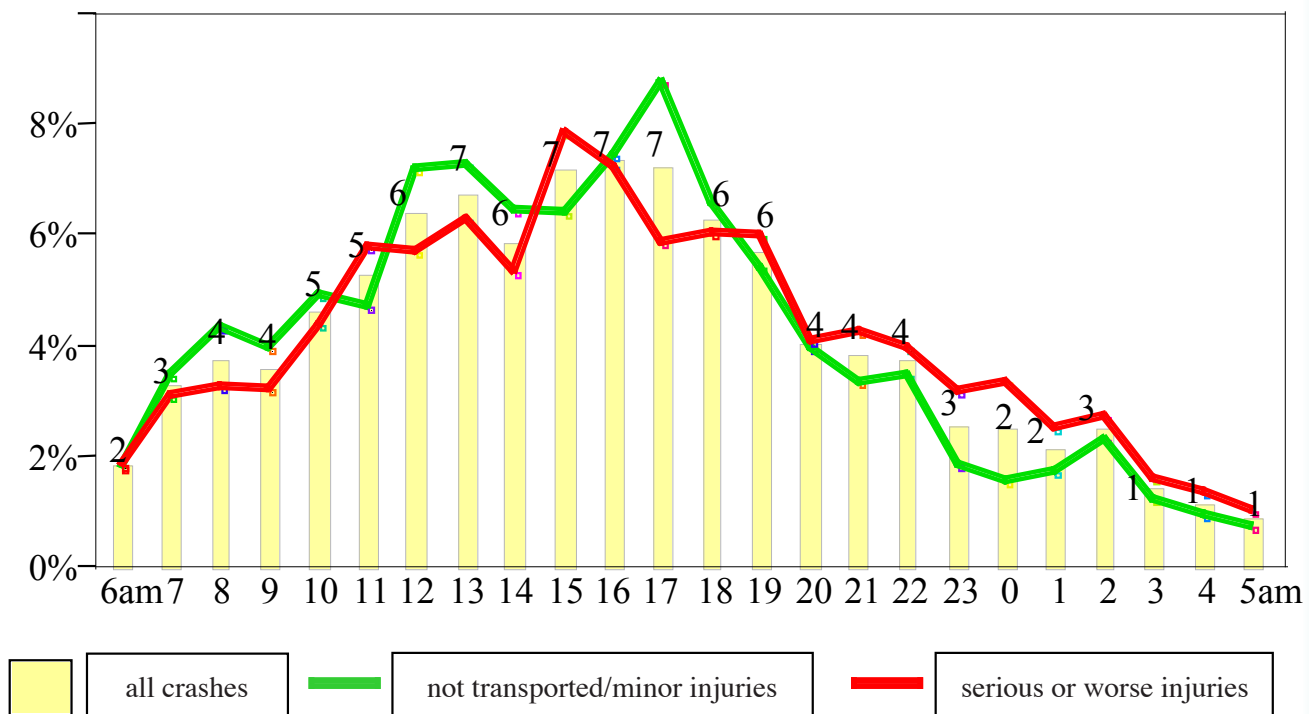
There were 3,724 EMS records for Hawaii residents who were treated by EMS personnel for injuries from motorcycle and moped crashes over the 5-year period. (Records for 79 patients whose residence could not be determined were excluded.) An additional 52 records of patients who were transferred to another ambulance were also excluded, to avoid double-counting. The final sample was 3,593 records. This total includes 128 patients who ultimately died from the crashes, since this is an important outcome to examine in terms of helmet usage by riders. (All deaths were confirmed by linkage to death certificates.)

The 3,593 injuries resulted from an estimated 3,444 separate crashes, as most (96%) of the crashes involved only a single injury. Figure 67 shows a broad peak in the time of the crashes from 9:31 a.m. to 7:29 p.m. (63% of crashes). Crashes with no patient transports or only minor/moderate injuries were somewhat more likely to occur daytime hours (5:29 a.m. to 7:30 p.m.), compared to crashes which resulted in “serious” or worse injuries (79% vs. 72%, respectively). Fifteen-percent (274) of the latter type of crashes occurred between 7:31 p.m. and 2:29 a.m.

Sundays (20%, or 710 crashes) and Saturdays (17%, or 614) were by far the most common days of the week for crashes (12% to 14% for all other days); more than one-third (37%, or 1324) of the crashes occurred on weekends. There were no large difference in the time distribution between weekend and weekday crashes, although 13% of the latter occurred during the morning rush hour period of 7:31 a.m. to 9:29 a.m., compared to only 7% of the weekend crashes. One-fifth (20%, or 2634 of 13,034 crashes) of the weekday crashes occurred during the 3-hour period from 2:31 p.m. to 5:29 p.m., compared to 15% (806) of the 5486 crashes on weekends.

Figure 67. Time distribution of EMS-attended motorcycle/moped crashes, by highest severity of injury in crash, 2007-2011.

(Horizontal scale indicates time of EMS dispatch, rounded up to nearest hour (military time scale, starting at 6:00am). Vertical scale indicates percent of all crashes, rounded to nearest whole number.)



Four of the 5 highest crash locations on Oahu were in the metropolitan Honolulu area, from Kalihi-Palama to Waikiki (Figure 68). Two-thirds (68%) of the 519 crashes in Hawaii County were in North Kona (46%) or South Hilo (21%) (Figure 69). The Wailuku and Lahaina districts accounted for most (78%) of the crashes on the island of Maui. There were also 13 crashes on the island of Molokai and 4 on Lanai (not shown on the Figure).

Figure 68. Number of EMS attended motorcycle/moped crashes on Oahu and eastern Oahu (bottom map), by Neighborhood Board, 2007-2011.

(Percent of all EMS-attended crashes in the state is shown in parentheses.)

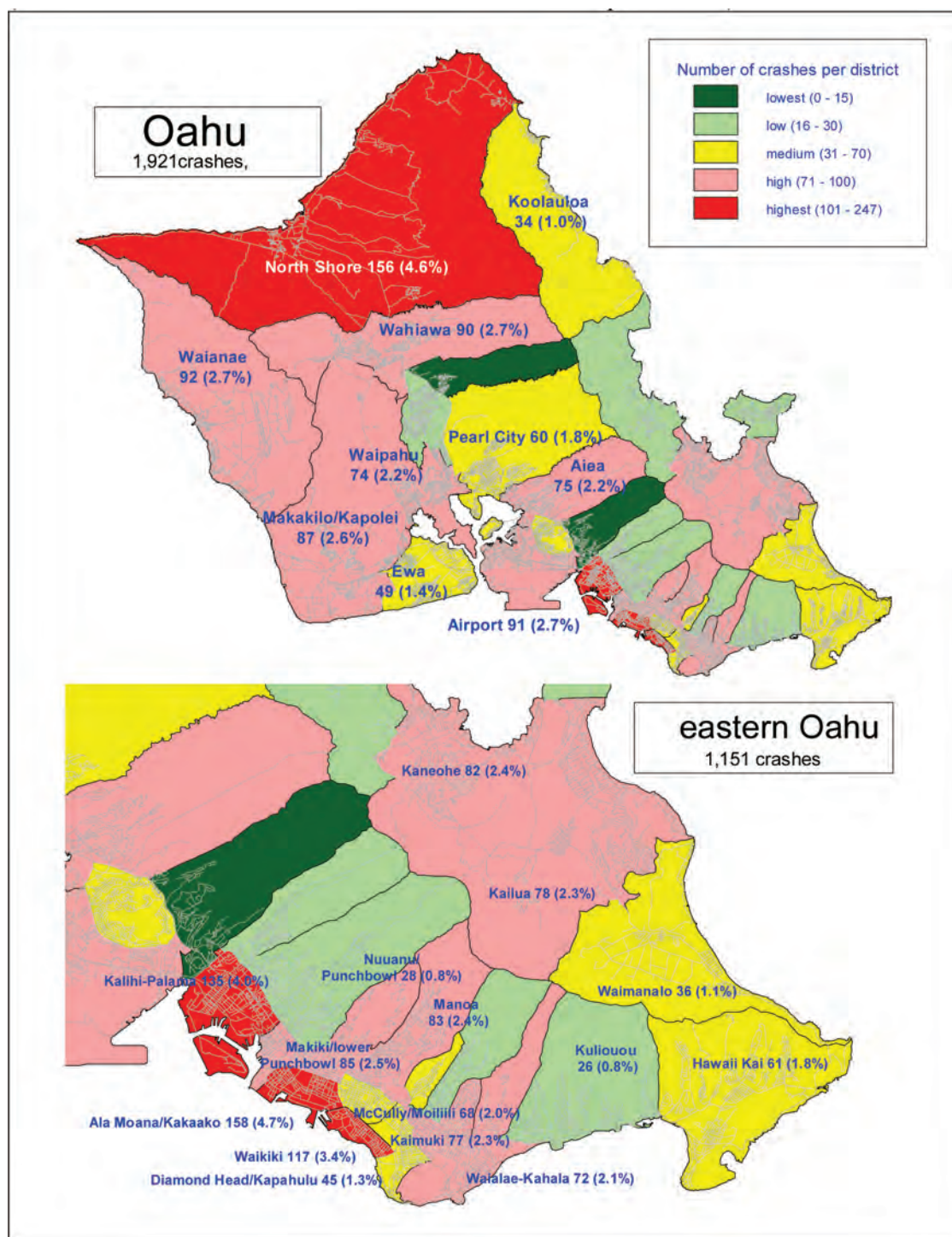
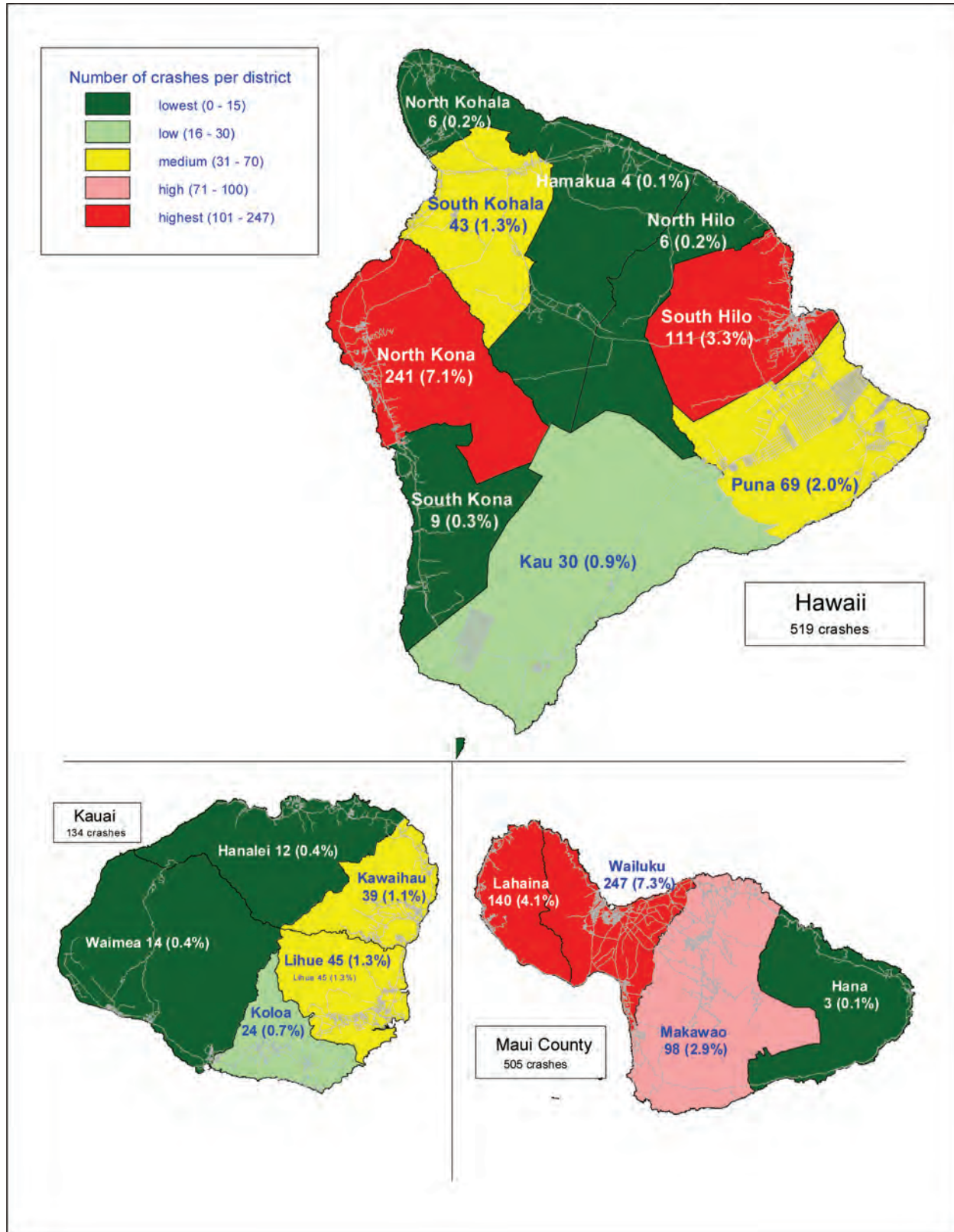


Figure 69. Number of EMS attended motorcycle/moped crashes on Neighbor Islands, by district, 2007-2011.

(Percent of all EMS-attended crashes in the state is shown in parentheses.)



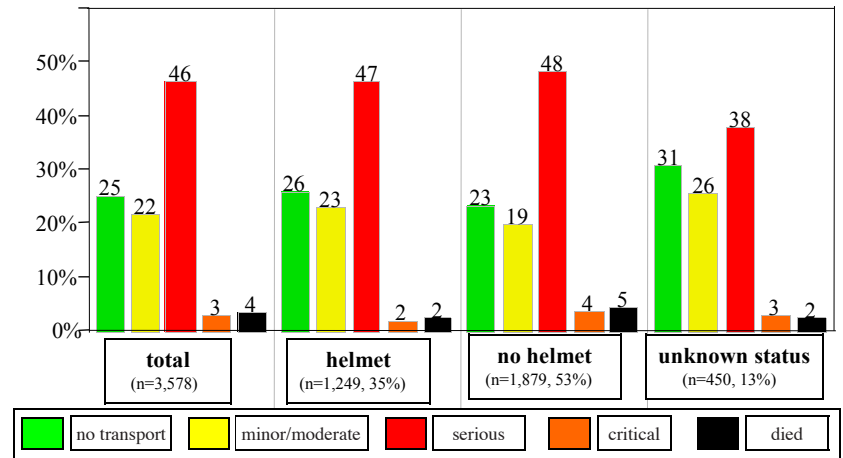
About half (47%, or 1688) of the riders refused EMS transport to hospitals (25%), or were transported with only “minor” or “moderate” injuries (22%) (Figure 70). Another 46% (1670) were transported with “serious” injuries, 107 in “critical” condition, and another 128 who ultimately died. (The latter status included those described as deceased on the scene as well as those linked to death certificates after they were transported to hospitals.)

Patient condition differed by helmet usage, as helmeted riders were significantly more likely to be transported with minor or moderate injuries (23%, compared to 19% for unhelmeted riders), and significantly less likely to be transported in critical condition (1.9% vs. 3.7%). The mortality rate among helmeted riders (2.5%, or 31 of 1249) was also significantly less than that among unhelmeted riders (4.6%, or 86 of 1879). Helmet status was not recorded for 13% (450) of these patients, whose disposition was generally more favorable than the other two groups of riders.

Due to software changes, information on the type of vehicle was available only for the 2007 through 2008 period and from July, 2011 onwards. Over those two time periods, 55% (1029 of 1868) of the riders were injured on motorcycles, 40% (750) were on mopeds, and vehicle status was unknown for the remaining 5% (89) riders. These proportions did not differ significantly across counties, although 64% of the riders in Kauai crashes were on motorcycles, compared to 52% to 56% for other counties. Only 36% of the riders were wearing helmets at the time of the crash, 50% were not helmeted, and the status was not available for the remaining 14% of riders (Figure 71). The proportion not wearing helmets was significantly higher, nearly doubled, among the moped riders (68%), compared to motorcycle riders (38%). These proportions are 84% and 43%, respectively, if riders with unknown helmet status are excluded.

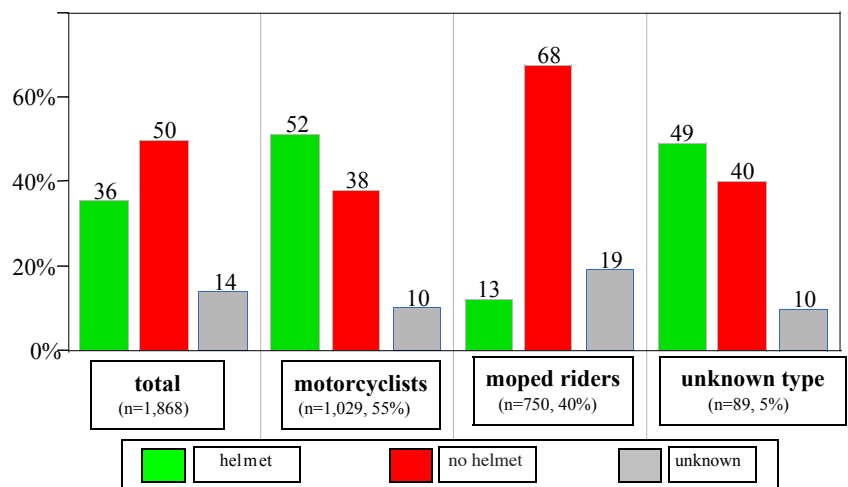
The positive associations between helmet use and patient disposition (Figure 70, above) was apparent for both types of riders. Helmeted moped riders were significantly less likely to be transported in critical condition or suffer fatal injuries (none among 94 riders), compared to unhelmeted riders (5%, or 26 of 510). Similarly, the rate of these types of injuries was significantly lower among helmeted motorcycle riders (5%, or 26 of 530), compared to unhelmeted riders (15%, or 59 of 392). The mortality rate among unhelmeted motorcycle riders (8.4%, or 33 of 392) was nearly 5 times that of helmeted riders (1.9%, or 10 of 530).

Figure 70. Distribution of injury severity/transport status of motorcycle and moped riders treated by EMS personnel, by helmet usage, 2007-2011.



*Not shown are 15 patients who were transported with injuries of unknown severity.

Figure 71. Helmet usage among motorcycle and moped riders treated by EMS personnel, 2007-2008, and July-December, 2011.



Probable alcohol use was noted for about 12% of the patients, as EMS personnel documented physical evidence (e.g. containers) at the crash scene, alcohol odor on the patients' breath, or the patient admitted to alcohol consumption (Table 13). This proportion was much higher among riders who crashed on Neighbor Islands (16% to 19%) than those who crashed on Oahu (10%). Alcohol users were significantly older than occupants who did not use alcohol, but by only 1 year on average. They were also more likely to be males, less likely to use helmets, and more likely to have been in a night time crash or a crash on the weekend. There were also significant differences in the disposition of patients, as those who had used alcohol were three times as likely to have been transported in critical condition, or to have died, compared to those who did not use alcohol. For the periods for which vehicle type was recorded, alcohol users were more likely to have been injured riding a moped (45%), compared to those who did not use alcohol (37%). Alcohol use was significantly more likely among moped riders than motorcycle riders (16% vs. 13%, respectively).

Table 13. Characteristics of motorcycle/moped riders treated by EMS personnel, by category of alcohol use, 2007-2011.

	Alcohol use (n=445, 12%)	No alcohol use (n=1,851, 52%)	No data/unknown (n=1,282, 36%)
Average age	37 years	35 years*	36 years
Gender (% male)	91%	81%*	82%*
Helmet use			
helmeted	14%	41%*	33%*
no helmet	77%	49%*	49%*
unknown	8%	10%	18%*
Disposition			
no transport	7%	29%*	27%*
minor/moderate injuries	17%	24%*	20%
serious injuries	60%	43%*	47%*
critical injuries	5.4%	1.6%*	4.1%
died	10.3%	2.9%*	2.3%*
Weekend crash (Sat/Sunday)	44%	36%*	35%*
Nighttime crash (8 pm - 5 am)	63%	18%*	21%*
Vehicle type#			
motorcycle	49%	58%*	50%
moped	45%	37%*	46%
unknown	6%	5%	4%

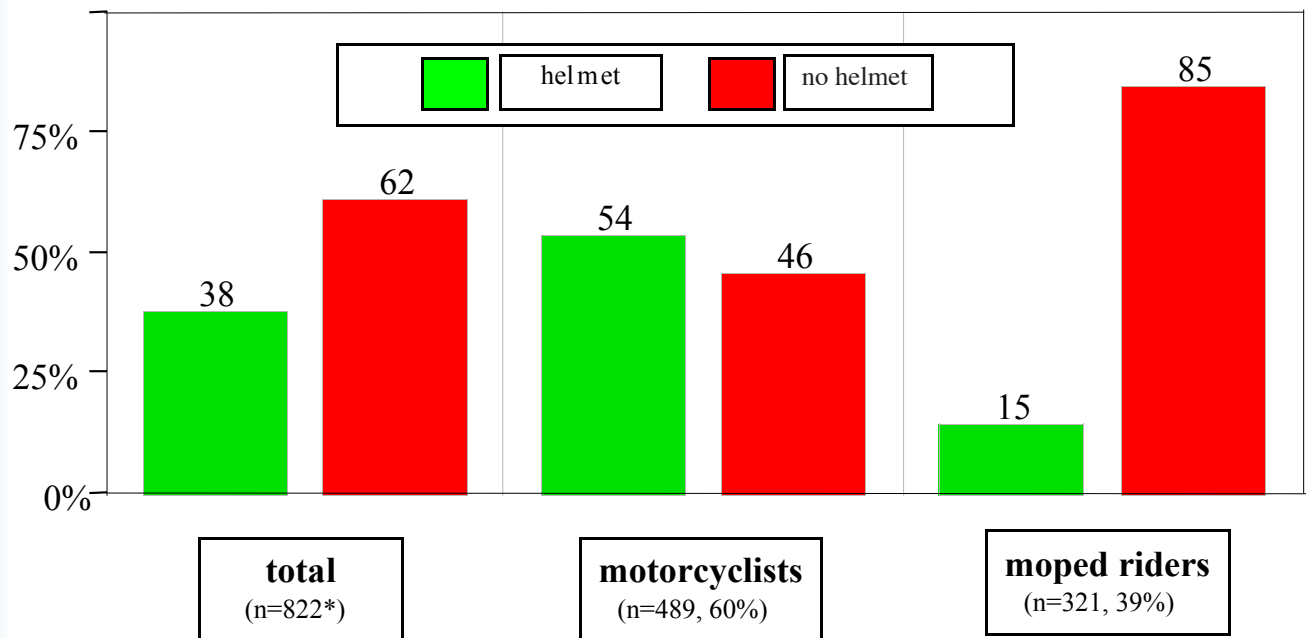
*Indicates statistically significant difference between riders who used alcohol vs. other riders.

#For patients injured during the 2007 through 2008 and July through December, 2011 periods.

This section summarizes results from the 2007 EMS data that was linked to multiple data systems: FARS, death certificates, DOT reports, and hospital records. Only about two-thirds (65%, or 538) of the 822 EMS records for injured Hawaii residents were probabilistically linked to DOT records, a lower proportion compared to injured occupants (72%, see page 63). That proportion only varied across counties by 60% (Kauai) to 66% (Honolulu). Hospital records were deterministically linked to 92% (600) of the 653 patients who were transported to hospitals by EMS. Hospital records were also linked to 51 additional EMS patients who refused EMS transport but apparently took private vehicles to hospitals.

Only 38% of the injured riders were wearing helmets at the time of the crash (Figure 72). This proportion differed greatly by the type of rider, as 54% of motorcyclists were wearing helmets, compared to only 15% of moped riders. (Helmet status was known for all but 3 (0.4%) of the riders.) Helmet use was highest among riders who crashed on Oahu (44%), 37% on Kauai, 28% in Hawaii County and only 26% in Maui County. The high proportion for riders on Oahu was mainly due to the 63% usage rate among motorcyclists injured there, compared to 35% to 48% of motorcyclists injured in other counties. Riders who used helmets were significantly younger (32 years, on average) compared to unhelmeted riders (36 years), and significantly more likely to be males (87%, vs. 81% males among unhelmeted riders).

Figure 72. Helmet use among motorcycle/moped riders treated by EMS personnel, by vehicle type, 2007



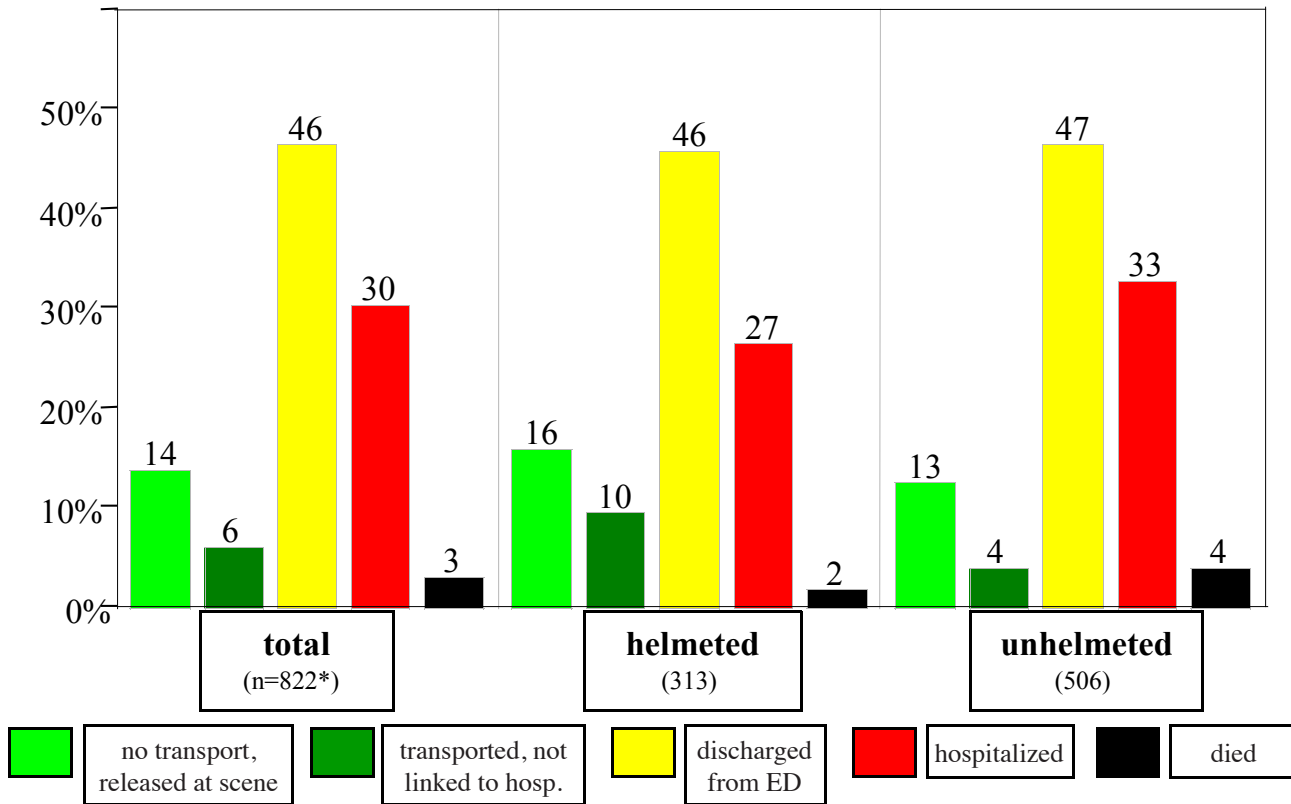
*Includes 10 riders of motor scooters and 2 of unknown types of vehicles.

Only 14% (114) of the 822 riders refused EMS transport and were released at the crash scene. About half (46%) were transported and eventually discharged from the ED, nearly one-third (30%) were hospitalized, and 3% (26) ultimately died from their injuries (Figure 73). The remaining 6% were transported by EMS, but could not be linked to hospital records. Paramedic described “minor” injuries for 66% of these patients, and “serious” injuries for 34%. This distribution is closer to that patients whose medical records showed a discharge from ED (49% with “minor” injuries, 51% with “serious”), than for patients who were eventually hospitalized or died from their injuries (13% minor, 87% “serious” or worse).

Helmeted riders had a significantly lower rate of the most severe injuries, those requiring hospitalization or resulting in death (28%, or 89 of 313), compared to unhelmeted riders (37%, or 186 of 506). The incidence of traumatic brain injury was nearly twice as high among unhelmeted riders (31%), compared to helmeted riders (18%).

There were no significant differences in the average hospital charges for helmeted and unhelmeted riders treated in either the ED (\$4,363, on average) or inpatient setting (\$70,139). The average length of each hospitalization was somewhat longer among unhelmeted riders (9.5 days, vs. 7.0 for helmeted riders), but not to a statistically significant degree.

Figure 73. Final medical disposition of motorcycle and moped riders treated by EMS personnel, by helmet use, 2007



* Includes 3 riders for whom helmet status was not known.

The odds of sustaining an injury that required hospitalization or resulted in death were 40% higher among unhelmeted riders compared to helmeted riders, and the former also had more than twice the odds of a fatal injury (Table 14). The odds of sustaining a traumatic brain injury were also more than double among unhelmeted riders compared to helmeted riders. All of these excess risk estimates were statistically significant and adjusted for the possible influence of rider age and gender and the county in which the crash occurred. The protective effects of helmet use were magnified if only motorcycle riders were considered. Unhelmeted motorcycle riders had twice the odds of an injury that required hospitalization or resulted in death, more than 3 times the odds of a fatal injury, and 3 times the odds of a TBI. In contrast, none of these odds varied significantly by helmet usage among moped riders, although it was not possible to assess the risk of fatal injuries, since there were only 3 among all 320 moped riders and none among the 48 who wore helmets.

Table 14. Adjusted* odds ratios for adverse medical dispositions among motorcycle/moped riders treated by EMS personnel, by helmet use, 2007

(Odds ratio 95% confidence intervals given in parentheses.)

	All riders		Motorcyclists only	
Restraint group	number (% of group)	odds ratios	number (% of group)	odds ratios
Odds of no transport (released at scene) or discharged from ED, vs. hospital admission or death				
helmeted	186/506 (37%)	1.0 (reference)	80/263 (30%)	1.0 (reference)
unhelmeted	89/313 (28%)	1.4 (1.2 – 1.9)	112/224 (50%)	2.1 (1.4 – 3.2)
Odds of no transport (released at scene) or transported to hospital, vs. death				
helmeted	6/313 (1.9%)	1.0 (reference)	6/263 (2.3%)	1.0 (reference)
unhelmeted	20/506 (4.0%)	2.2 (0.9 – 6.1)	17/224 (7.6%)	3.3 (1.3 – 9.8)
Odds of traumatic brain injury				
helmeted	56/313 (17.9%)	1.0 (reference)	44/263 (16.7%)	1.0 (reference)
unhelmeted	158/506 (31.2%)	2.2 (1.5 – 3.1)	78/224 (34.8%)	3.1 (2.0 – 5.0)

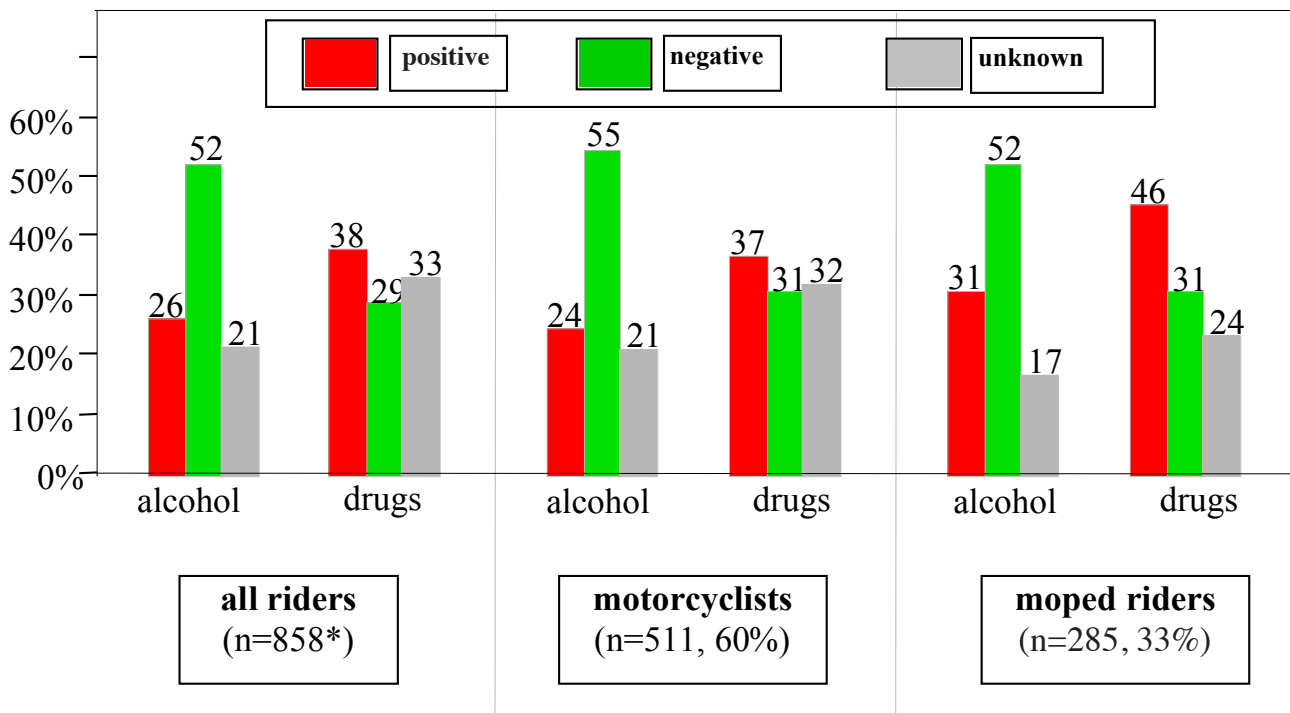
*Adjusted for occupant age, gender, and county in which crash occurred.

Trauma Registry data

About one-fourth (26%) of the injured resident motorcycle/moped riders in the HTR tested positive for alcohol, including 21% (178) with BAC levels of 0.08 or greater, and 14% (117) with BAC levels of 0.16% or greater (Figure 74). Moped riders were significantly more likely than motorcyclists to have been drinking (31% vs 24%, respectively). More than half (54%, or 464) of the riders tested positive for either alcohol or drugs, including most (78%) of the 285 moped riders. The most commonly occurring drugs were narcotics (21% of patients), THC (17%), and amphetamines (9%). Moped riders were significantly more likely to test positive for THC (24%, vs 15% for motorcyclists).

There were no significant differences in the age or gender distribution of riders who were drinking and riders who tested negative for alcohol. Helmet usage was significantly lower among the former, however, as only 17% wore helmets, compared to 37% of the non-drinkers. Among motorcyclists, helmet usage was 52% among the non-drinkers compared to only 23% among those who were positive for alcohol. Alcohol usage was comparable between riders who crashed on weekends and those who crashed on weekdays (26% for each group), but 4 times more common among those who crashed during night time (54%) compared to those who crashed between 6:30 a.m. and 7:29 p.m. (14%). The mortality rate among drinkers (7.5%, or 17 of 226) was significantly higher than that among non-drinkers (3.8%, or 17 of 448). This elevated risk of mortality was more apparent among the motorcyclists than the moped riders.

Figure 74. Alcohol and/or drug use (percent) among motorcycle/moped riders in the Hawaii Trauma Registry, by seating position, 2008-2011.



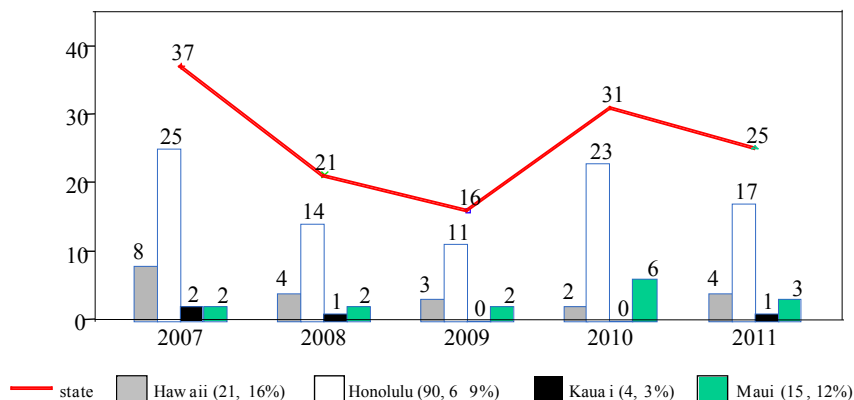
*Includes 62 patients for whom seating position was not known.

Pedestrians

Fatal injuries

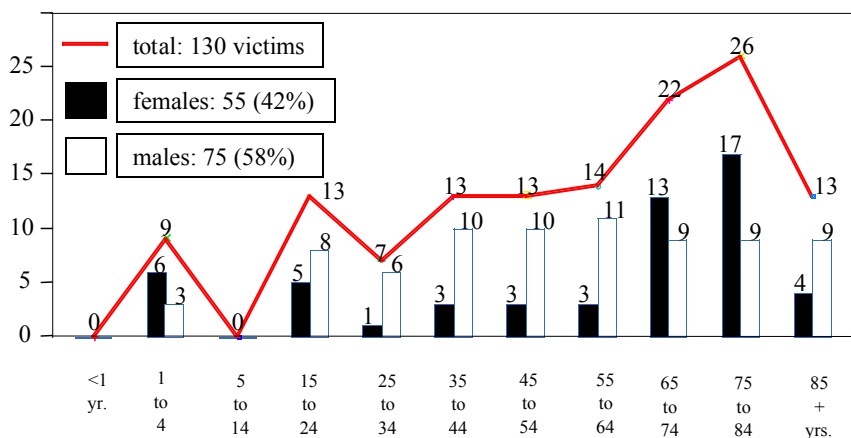
Pedestrian crashes were 7th leading cause of fatal unintentional injuries, as 130 pedestrians were killed in Hawaii over the 5-year period. The annual number of deaths varied inconsistently between 16 and 37 (Figure 75). The deaths were caused by 129 separate crashes, as 1 crashes involved 2 victims. More than two-thirds of the victims (69%, or 90) were struck on Oahu. Another 21 were struck on the island of Hawaii, 15 in Maui County (all on the island of Maui), and only 4 on Kauai. The unadjusted 5-year mortality rate for Honolulu County (10.3 deaths/100,000 residents) was significantly lower than the rates for Hawaii (13.8) and Maui (13.3) counties. There were no significant differences in standardized fatality rates between any county, although these comparisons are limited by the small sample sizes for other than Honolulu County.

Figure 75. Annual number of pedestrian fatalities among Hawaii residents, by county, 2007-2011.



The ages of the victims ranged broadly from 1 to 97 years, although nearly half (47%, or 61) were 65 years or older (Figure 76). Most (80%, or 49) of the senior-aged victims were struck on Oahu, although the 5-year pedestrian fatality rate for senior residents on Oahu (35.9/100,000) was statistically comparable to the rate for Neighbor Island senior residents (22.4/100,000). Nine of the victims were either 1 (7 victims) or 2 (2 victims) years of age. Seven of these victims were run over in private driveways, mostly (6 victims) by a sports utility vehicle. The majority (86%, or 75) of the 130 total victims were males, although female comprised the majority (6 of 9) of toddler-aged victims and senior-aged victims (56%, or 34 of 61). The 13 deaths among residents aged 85 years and older translated into the highest fatality rate (39.2 deaths/100,000), followed by 75-84 year-olds (39.2) and 65-74 year-olds (24.2). Rates for all other age groups ranged from 0 to 10.5 deaths/100,000 residents.

Figure 76. Age and gender distribution of fatally injured pedestrians in Hawaii, 2007-2011.

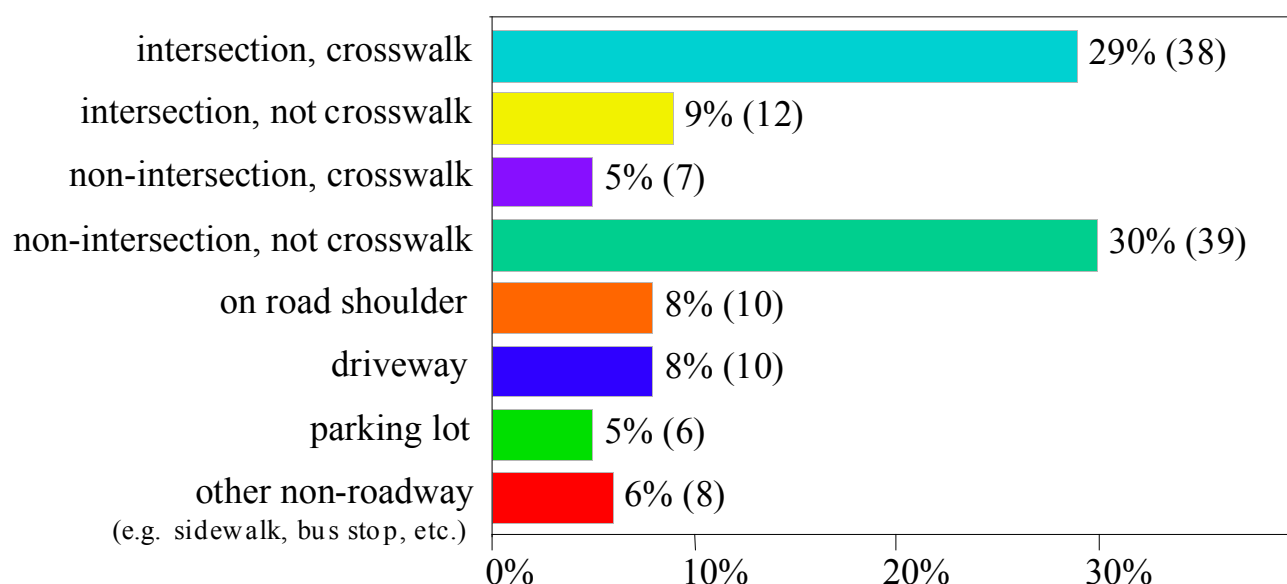


There was no apparent pattern to the month of the year or day of the week in which these fatal crashes occurred. Unlike many other categories of injuries (e.g. drownings, homicides, car crashes) there was not a high frequency of pedestrian fatalities on weekends. The lowest totals were seen for Wednesdays and Thursdays (14 crashes each), with totals varying between 19 and 21 crashes for the other days of the week. The crashes occurred at all hours of the day, but there were two noticeable peak periods: 27 crashes (21% of the total) occurred between 5:31 a.m. and 9:29 a.m., and 40 (31%) took place between 5:31 p.m. and 11:29 p.m.. (These statistics exclude 2 deaths (2% of the total) for which the time of

the crash was not known.) Temporal patterns were associated with the age of the victim, as most (74%, or 20 of 27) of the victims during the morning peak were 65 years of age or older, while most (75%, or 30 of 40) of those struck during the 5:31 p.m. to 11:29 p.m. peak were under 65 years of age. Most (81%) of the senior-aged victims (85%) and all 9 who were under age 15 were struck during daylight hours (5:31 a.m. to 7:29 p.m.). In contrast, most (73%) of the victims aged 25 to 54 years were hit during nighttime hours, between 7:31 p.m. and 5:29 a.m. There were no associations between time of the crash and day of the week or county.

Only about one-third of the victims (34%, or 45) were known to have been in a crosswalk at the time of the crash, usually at an intersection (29% of victims) (Figure 77). There were nearly equal numbers of victims who were hit at intersections (50, or 38%) and who were hit on open stretches of roadway (46, or 35%). Another 8% were hit while on the shoulder of the road, 8% in driveways, 5% in parking lots, and 6% in other off-road environments (e.g. sidewalks, bus stops, etc.). The environment differed between senior-aged victims and those under 65 years of age, as the former were more likely to be hit in a crosswalk (56% vs. 16%), while younger victims were likely to be hit in driveways (10% vs. 5% for senior-aged victims), on road shoulders (14% vs. none), and on open stretches with no crosswalk (43% vs. 15%). Victims hit on Oahu were more likely to have been in a crosswalk than those hit on Neighbor Islands (44% vs. 13%).

Figure 77. Number of pedestrian fatalities among Hawaii residents, by location on roadway, 2007-2011.



Only 80% (84) of the 105 fatalities from 2007 to 2010 could be matched to FARS records, since this only includes pedestrians hit on public roadways, and also excludes those who died more than one month after the crash. FARS data contains information on alcohol involvement in the crash, and contributing factors for both pedestrians and drivers involved in the crashes. The rest of this section (excluding the maps) will utilize only the data from the 84 pedestrian deaths (from 84 separate crashes) that were linked to FARS records.

The most common speed zone for the 125 crashes was 25 miles per hour (45%, or 38 crashes). Another 35% (29 crashes) were in 30 to 35 mph zones; only 18% (15) were in 40 mph or faster zones. Crashes on Oahu were

more likely to be in 25 mph or slower zones, compared to those on Neighbor Islands (58% vs. 24%). Almost two-thirds than half (63%) of the senior-aged victims were hit in 25 mph or slower zones, compared to 33% of pedestrians under the age of 65 years. All but 5 of the crashes occurred on roads with two-way traffic, usually (66%) with undivided lanes. Most (80%, or 67) of the crashes involved a vehicle going straight. Most of the remaining crashes (15%, or 13) involved a vehicle making a left turn, and 1 crash happened while a car was changing lanes. (This information was not available for the remaining 3 crashes.) Crashes on Neighbor Islands (88%) were more likely to involve cars going straight, compared to crashes on Oahu (76%).

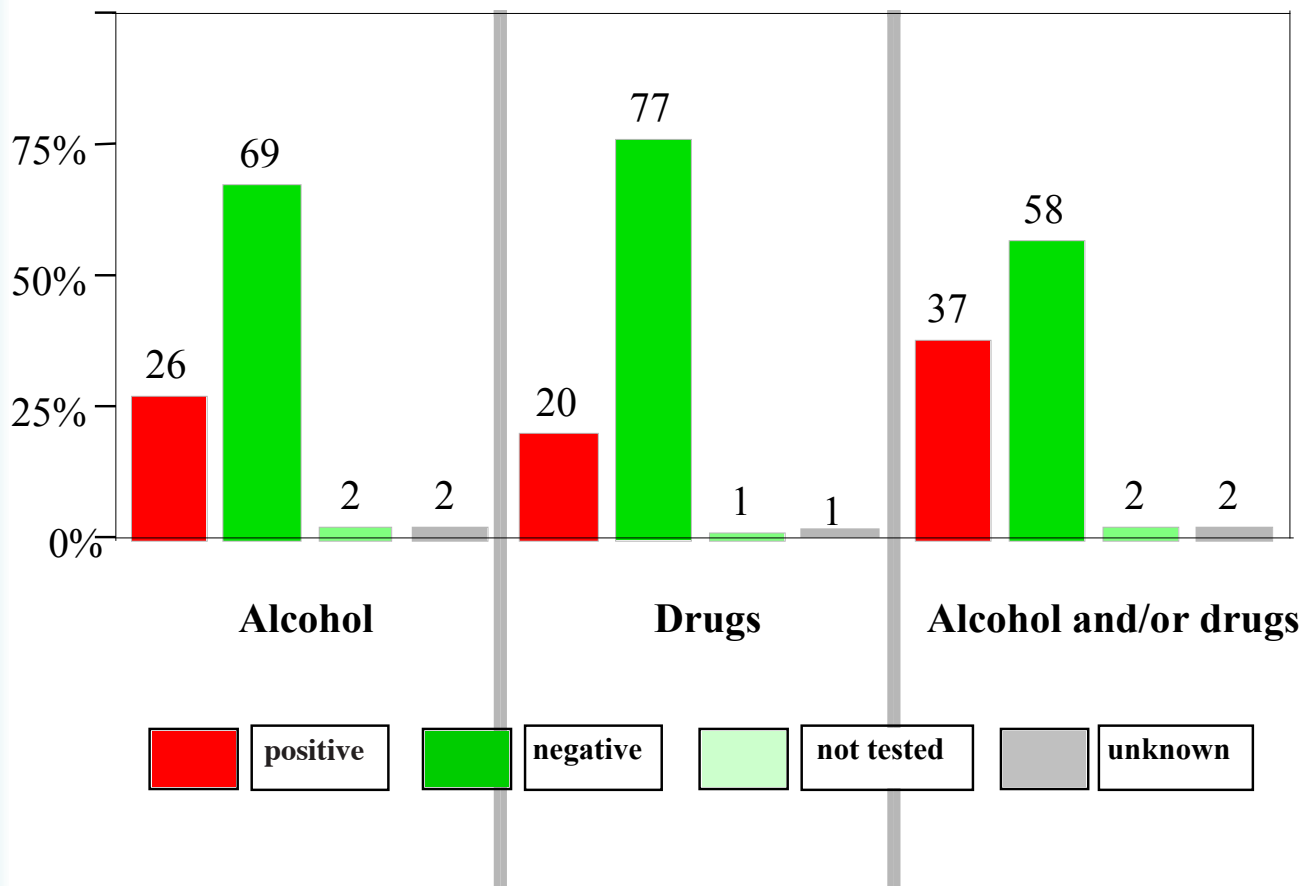
More than one-quarter (26%) of the 84 fatally injured pedestrians tested positive for alcohol, and 25% had BAC levels of 0.08% or higher (Figure 78). Alcohol use was significantly higher among male victims (42%) compared to females (6%). Drinkers were also significantly younger on average than those who tested negative for alcohol (44 vs. 66 years). The highest prevalence of alcohol use was seen among victims in the 21 to 34 year age group (70%, or 7 of 10), and the 35 to 54 year age group (52%, or 11 of 21). Only 5% (2 of 41) of the senior-aged victims tested positive for alcohol. Alcohol use was four times as prevalent among pedestrians hit on the Neighbor Islands (56%) compared to those hit on Oahu (14%). There was little association between alcohol use and the day of the week the crash occurred. However, alcohol use was much more likely among victims hit between 7:31 p.m. and 5:29 a.m. (51%, or 18 of 35), compared to those struck during the daylight hours (8%, or 4 of 49).

Alcohol was actually involved in 33% (28) of these 84 fatalities, as 6 pedestrians who tested negative for alcohol were hit by drivers who had been drinking. Overall, 15% (13) of the 88 drivers involved in the crash tested positive for alcohol, including 6% (5 drivers) who had BAC of 0.08% or higher.

Opiates (5 victims), methamphetamine (5), and thc (3) were the most commonly detected drugs among the 84 decedents. The profile of drug users was similar to that for pedestrians who tested positive for alcohol: drug users were younger, and more likely to be males. Drug use was also more common among pedestrians who were hit during nighttime hours (31% of victims, vs. 12% for victims hit at other times), and among pedestrians hit on Neighbor Islands (48% vs. 8% for pedestrians hit on Oahu).

Overall, 37% (or 31) of the 84 victims were possibly impaired by alcohol and/or drugs. This proportion was particularly high among younger victims (83% of the 24 victims between 21 and 49 years of age), those hit on Neighbor Islands (76%), and those hit during nighttime hours (66%).

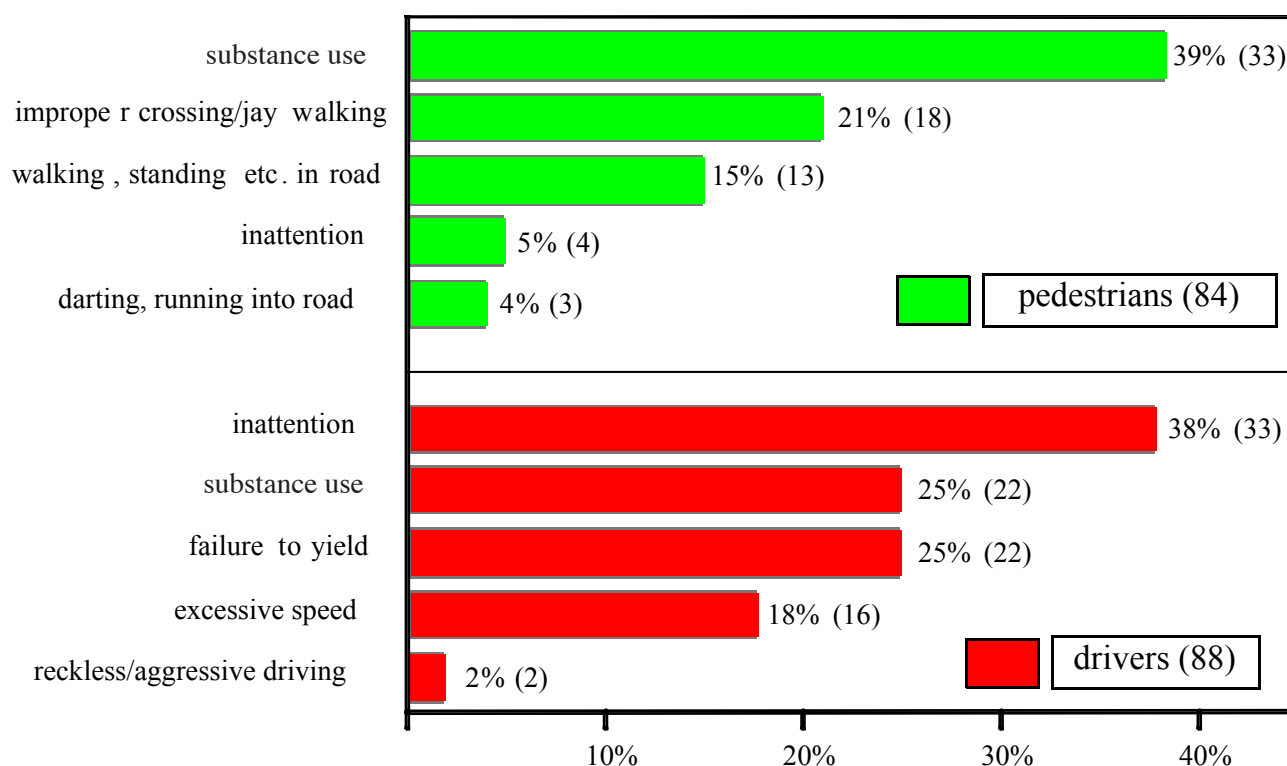
Figure 78. Alcohol and/or drug use (percent) among pedestrians killed in Hawaii, 2007-2010.



According to FARS data, 39% (33) of the pedestrian victims were in the roadway erroneously, most commonly by “improper crossing of roadway or intersection”, including jaywalking (21%, or 18 victims) (Figure 79). Including the victims who tested positive for alcohol or drugs, 54% (or 45) of the pedestrians made an error that contributed to the crash. Pedestrians who tested positive for alcohol or drugs were significantly more likely to have been in the roadway illegally, usually while crossing, than were the other victims (66% vs. 22%).

More than half (59%, or 52) of the 88 drivers made an error which contributed to the crash. Most commonly, they were described as “inattentive” (38%), failed to yield the right of way (25%), or were speeding (18%). One-quarter (25%) tested positive for alcohol or drugs. Errors were documented for about two-thirds (67%, or 40) of the 60 drivers involved in crashes in Honolulu County, a significantly higher proportion than for drivers involved in crashes in other counties (43%, or 12 of 28 drivers).

Figure 79. Contributing factors for fatal pedestrian crashes in Hawaii, by person type, 2007-2010.



The approximate location of the pedestrian crashes for Oahu and the Neighbor Islands are shown in the following maps. The areas of Kalihi-Palama (13 deaths), Waianae (10), Waipahu (6), and Makakilo/Kapolei, McCully/Moiliili, and Waikiki (5 each) had the highest totals on Oahu (Figure 80). The highest numbers of crashes on the Neighbor Islands were generally in the urbanized parts of Maui and Hawaii, with 10 in Wailuku, 6 in North Kona, and 5 each in the Lahaina, South Hilo and Puna districts (Figure 81).

Figure 80. Approximate location of fatal pedestrian crashes on Oahu and eastern Oahu (bottom map), by age group of victim, 2007-2011.

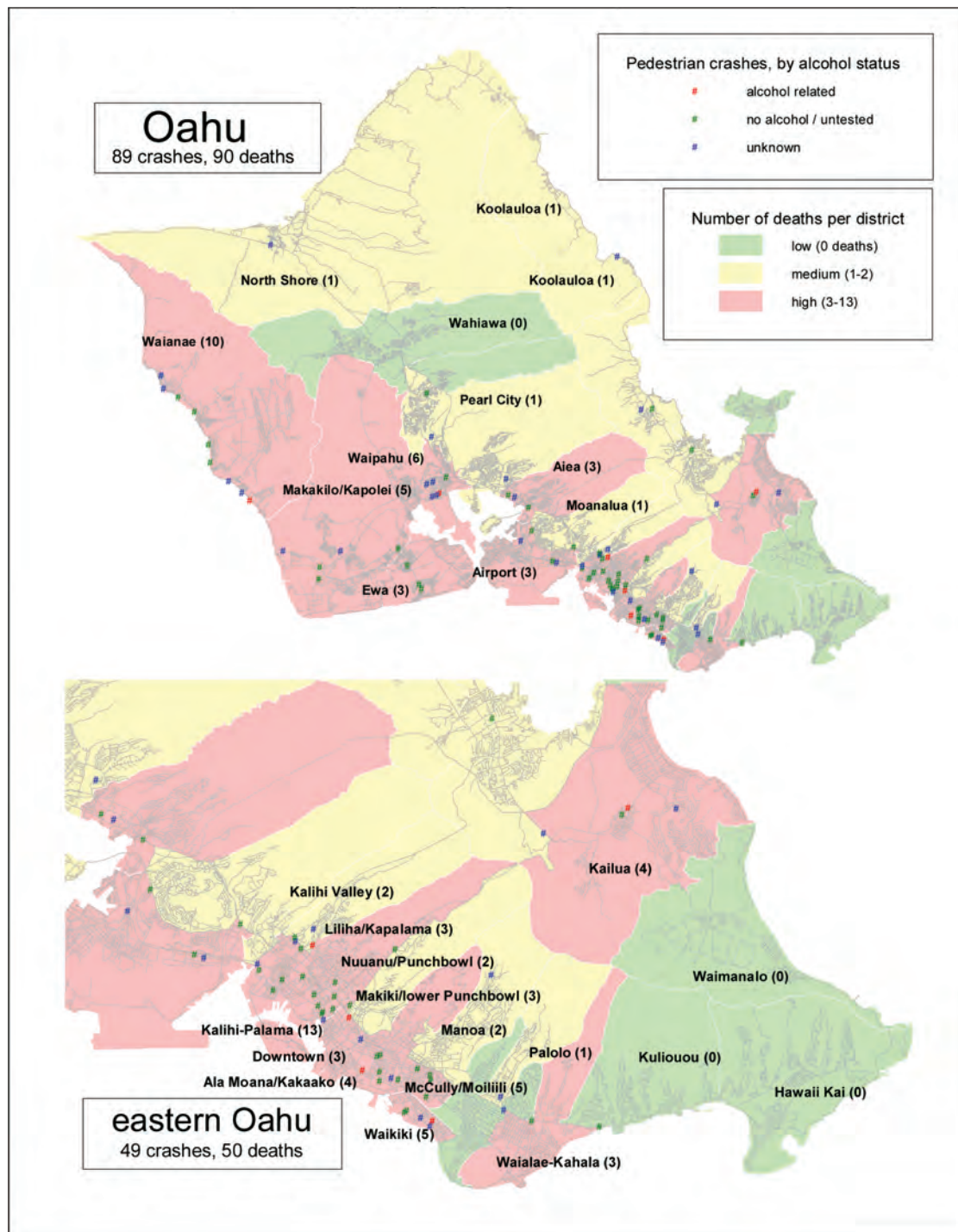
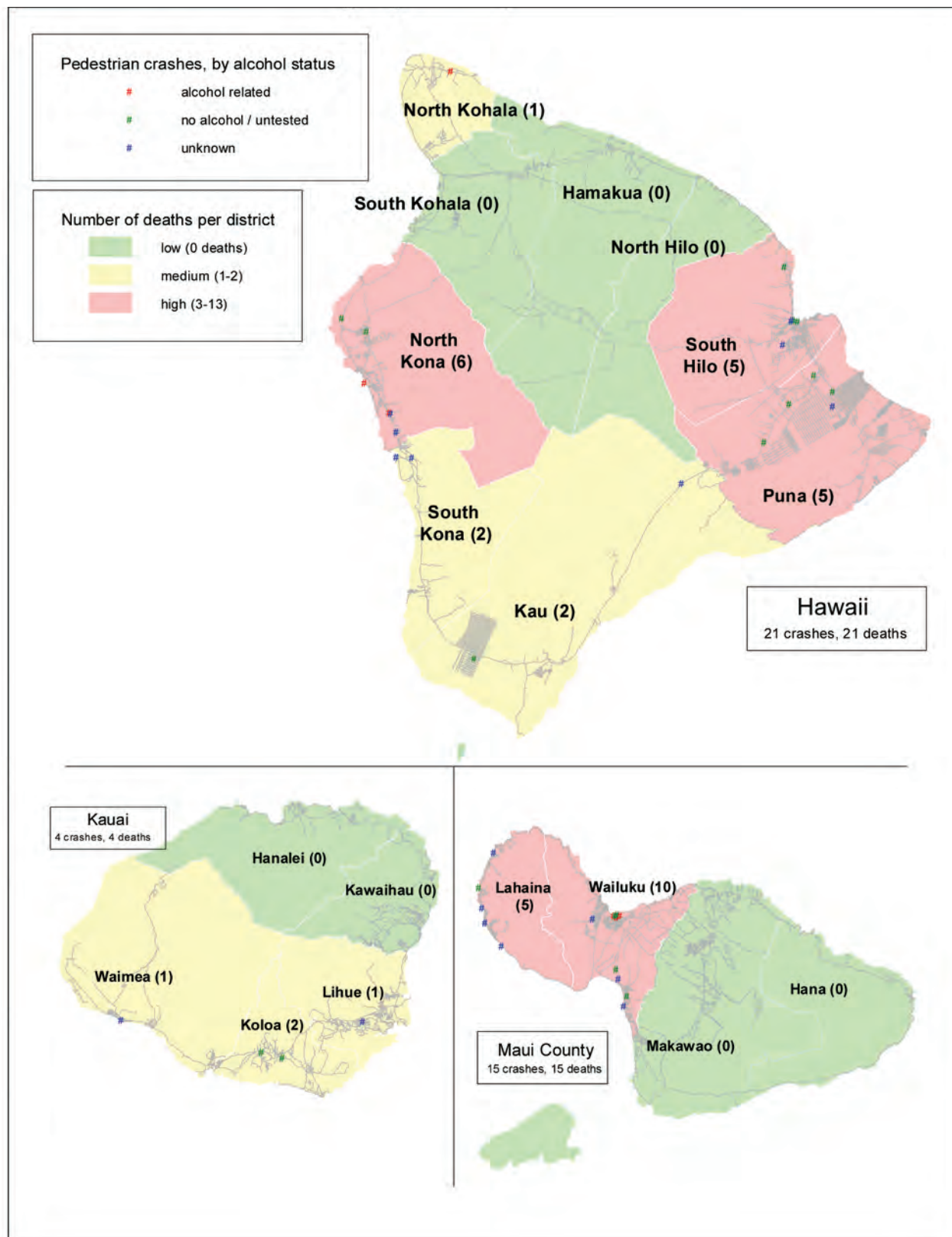


Figure 81. Approximate location of fatal pedestrian crashes on Neighbor Islands, by age group of victim, 2007-2011.



Nonfatal injuries

There was a slight decrease in the annual number of nonfatal injuries among pedestrians that were treated in EDs, although the total changed little after 2008 (Table 15). There was no apparent trend in injuries requiring hospitalization. Gender was nearly equally distributed, with slightly more males for both ED visits (55%) and hospitalizations (56%). These proportions were reversed among senior-aged patients, of whom 59% were female and 41% were male. Patient age was widely distributed, but one-third (32%) were in the 5 to 24 year age group. Patients who were hospitalized were generally older; 27% were 65 years or older, compared to 13% of patients who were treated in EDs. About three-fourths (72%) of the patients were residents of Honolulu County, including 78% of those who were admitted to hospitals.

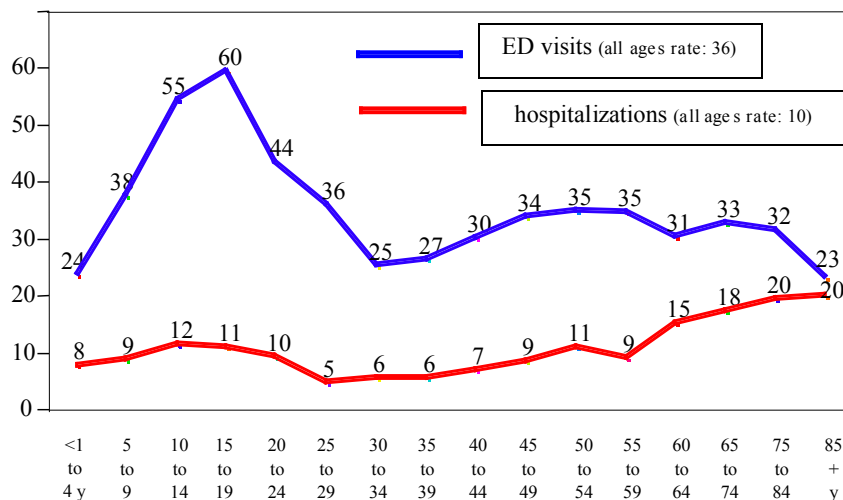
Table 15. Demographic characteristics* of Hawaii residents with nonfatal injuries from pedestrian crashes.

	ED visits	hospitalizations	total
Year of admission			
2007	507	142	649
2008	489	135	624
2009	441	125	566
2010	444	139	583
2011	440	143	583
average annual total	464	137	601
Patient gender			
Female	210 (45%)	61 (44%)	271 (45%)
Male	254 (55%)	76 (56%)	330 (55%)
Patient age			
infants	0 (0%)	0 (0%)	0 (0%)
1-4 y	21 (4%)	7 (5%)	28 (5%)
5-14 y	73 (16%)	16 (12%)	89 (15%)
15-24 y	90 (19%)	18 (13%)	108 (18%)
25-34 y	58 (13%)	11 (8%)	69 (11%)
35-44 y	49 (11%)	11 (8%)	60 (10%)
45-54 y	63 (14%)	18 (13%)	81 (14%)
55-64 y	52 (11%)	20 (14%)	71 (12%)
65-74 y	30 (7%)	16 (12%)	46 (8%)
75-84 y	21 (4%)	13 (10%)	34 (6%)
85+ y	7 (2%)	6 (5%)	14 (2%)
County of residence of patient			
Hawaii	66 (14%)	14 (10%)	80 (13%)
Honolulu	328 (71%)	106 (78%)	434 (72%)
Kauai	25 (5%)	4 (3%)	29 (5%)
Maui	45 (10%)	13 (9%)	58 (10%)

*Statistics are annual averages over the 2007-2011 period.

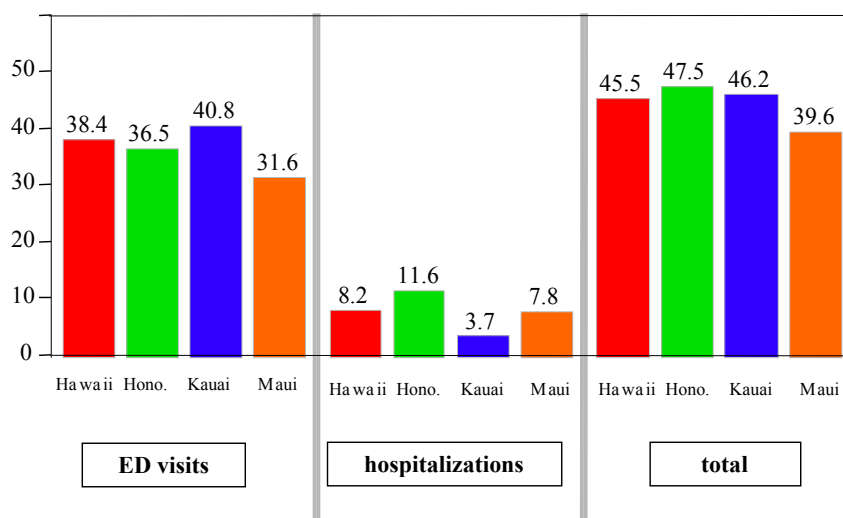
Residents aged 5 to 24 had the highest rates for injuries treated in EDs, with a peak in the 15 to 19 year age group (Figure 82). Rates for ED visits were relatively low for ages 30 and older, especially among residents aged 85 years and older. A different pattern was seen for hospitalizations, with low rates for residents under 60 years of age, but progressively higher rates among older residents. For all injuries (combining ED visits and hospitalizations), there were two peak age ranges: from 5 to 24 years of age (60 injuries/100,000 residents), and 65 years and older (50/100,000).

Figure 82. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for nonfatal injuries from pedestrian crashes in Hawaii, by age of patient, 2007-2011.



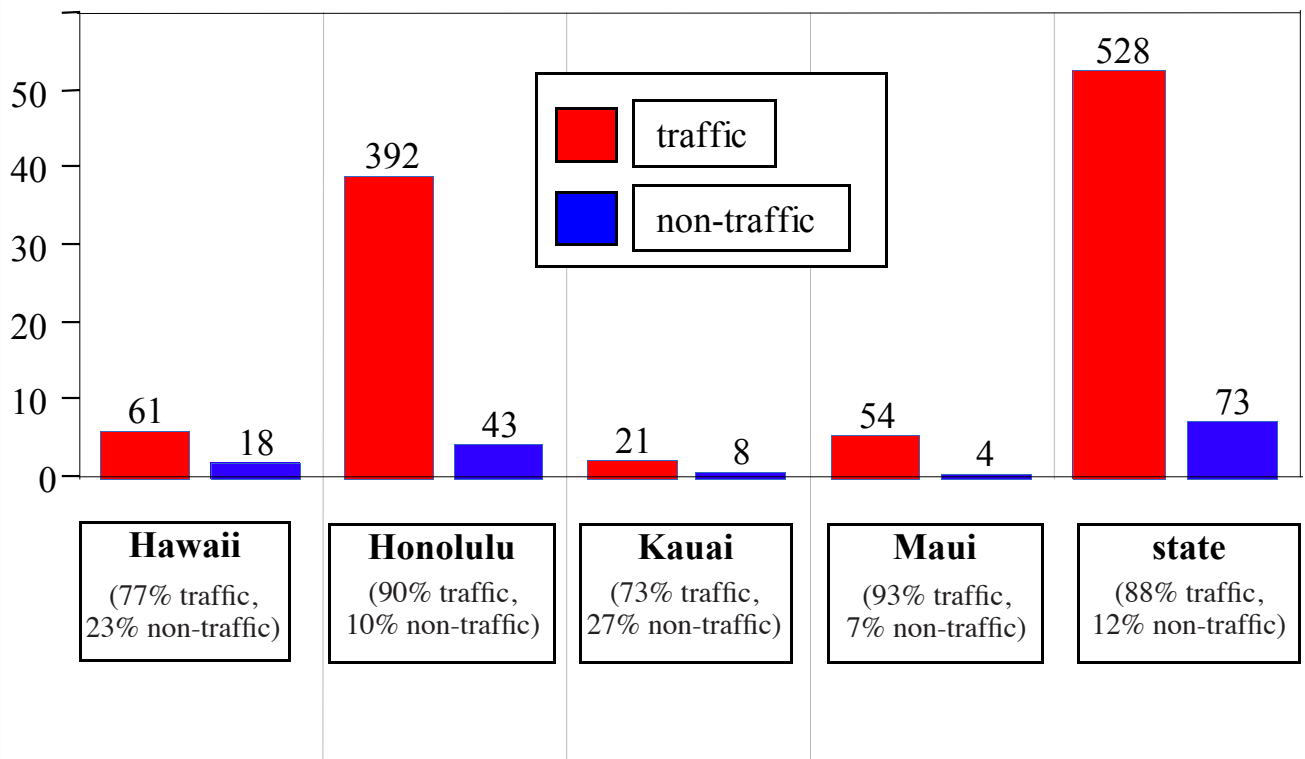
Residents of Maui County had the lowest rates of all nonfatal pedestrian injuries (ED visits combined with hospitalizations), although none of the rate differences between counties were statistically significant (Figure 83). Kauai County residents had the lowest rates of injuries requiring hospitalization, although this comparison is limited by small numbers (Table 11).

Figure 83. Age adjusted annual rates (per 100,000 residents) of nonfatal injuries from pedestrian crashes, by level of care and county of residence of patient, 2007-2011.



Most (88%) of the nonfatal injuries were coded as “traffic” related, or occurring on a public roadway, while 12% were in “non-traffic” environments, including private roads, driveways and parking lots (Figure 84). That proportion varied by the county of residence of the patients, however, and was significantly higher for patients from Oahu (90%) and Maui counties (93%), compared to those from Hawaii or Kauai counties. Proportionally more of the injuries treated in EDs were from non-traffic crashes compared to those requiring hospitalization (14% vs. 7%), perhaps reflecting higher speeds among the latter types of crashes. Patients who were injured from non-traffic crashes were significantly younger on average than those involved in traffic crashes (34 vs. 38 years, respectively), as there were more young patients (ages 1 to 14 years) among those who were injured in non-traffic crashes (30% vs. 18%, respectively).

Figure 84. Average annual number of nonfatal injuries from pedestrian crashes in Hawaii, by type of crash and county of residence of patient, 2007-2011.



Patients were hospitalized for 9 days on average, and hospitalizations comprised most (73%) of the total days of care from nonfatal injuries to pedestrians and 87% of the associated medical charges (Table 16). More than half (61%) of the hospitalized patients had fractures, most commonly leg fractures (27%), and one-quarter (26%) had internal injuries. Thirty-nine percent of these patients had a traumatic brain injury. Fractures (13%) and internal injuries (5%) were much less common among the pedestrians treated in EDs, about half (48%) of whom were treated for contusions or superficial injuries.

Table 16. Clinical characteristics* of Hawaii residents with nonfatal injuries from pedestrian crashes.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	9.0	2.8
Total number of days	464	1,229	1,693
Average charge	\$2,880	\$59,886	\$15,709
Total charges	\$1.3 million	\$8.2 million	\$9.4 million
Primary injury diagnosis			
fractures	60 (13%)	83 (61%)	143 (24%)
fracture of skull	2 (1%)	15 (11%)	18 (3%)
vertebral column	4 (1%)	10 (7%)	14 (2%)
ribs, pelvis or trunk	8 (2%)	15 (11%)	24 (4%)
humerus	5 (1%)	3 (2%)	8 (1%)
lower arm or hand	12 (3%)	3 (2%)	15 (3%)
femur	1 (0%)	9 (7%)	10 (2%)
lower leg or foot	27 (6%)	27 (20%)	54 (9%)
sprains and strains	50 (11%)	1 (1%)	51 (8%)
internal injuries	24 (5%)	35 (26%)	59 (10%)
open wounds	34 (7%)	7 (5%)	40 (7%)
contusion/superficial	225 (48%)	3 (2%)	228 (38%)
other/unspecified	73 (16%)	8 (6%)	81 (13%)
traumatic brain injury (any priority diagnosis)	71 (15%)	54 (39%)	125 (21%)

*Statistics are annual averages over the 2007-2011 period.

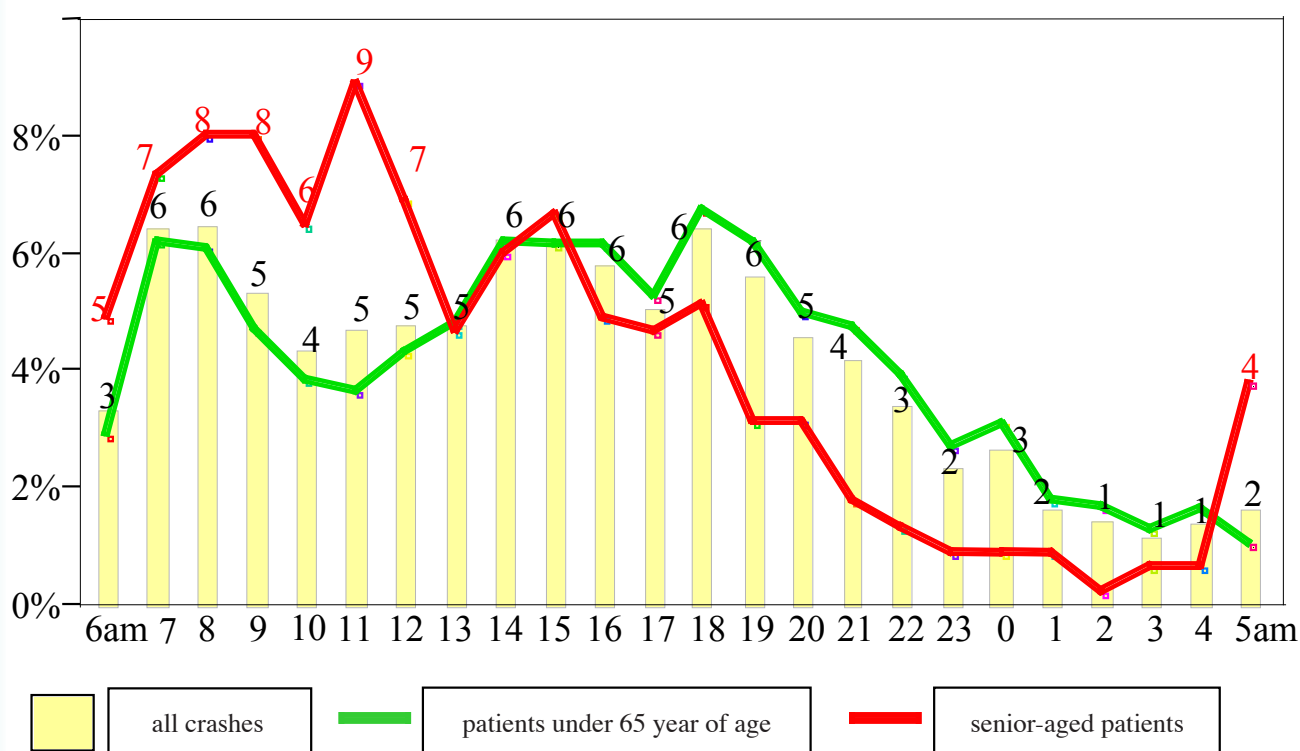
There were 2,335 EMS records for Hawaii residents who were treated by EMS personnel for occupant injuries over the 2007 to 2011 period. (Records for 182 patients whose residence could not be determined were excluded.) To avoid double-counting of injuries, the records of 22 patients who were transferred to another ambulance were excluded, resulting in the final sample of 2313 records. Included in this total were 114 patients who ultimately died from the crashes, since this is an important outcome to examine in terms of patient age. (All of these deaths were confirmed by linkage to death certificates.)

The patients were injured in 2,225 separate crashes, as most (96%) crashes involved only a single patient. There were 2 peak periods for the time of the crashes, from 6:31 a.m. to 8:29 a.m. (13%, or 287 crashes), and from 2:29 p.m. to 7:29 p.m. (35%, or 788 crashes) (Figure 85). Most (76%, or 1682) of the crashes occurred during daytime hours (5:29 a.m. to 7:30 p.m.). The time distribution differed by patient age, as crashes with senior-aged pedestrians were more likely to occur during daytime hours (86%), compared to crashes involving pedestrians under 65 years of age (73%). Only a minority (12%) of the night time crashes involved senior-aged pedestrians.

There was no clear pattern as to the day of the week for crashes, although the lowest totals occurred on Sundays (10%, or 218 crashes, compared to 318 to 358 crashes for other days of the week). Nearly one-third (31%) of the crashes on weekends occurred during nighttime hours (31%), compared to 22% of crashes during the week.

Figure 85. Time distribution of EMS-attended pedestrian crashes, by highest age of patient in crash, 2007-2011.

(Horizontal scale indicates time of EMS dispatch, rounded up to nearest hour (military time scale, starting at 6:00am). Vertical scale indicates percent of all crashes with injured pedestrians, rounded to nearest whole number.)



The locations with the 3 highest pedestrian crash totals on Oahu were all in the metropolitan Honolulu area: Ala Moana/Kakaako, Kalihi-Palama, and Downtown (Figure 86). Other high frequency areas were Waianae, Waipahu, and Waikiki. South Hilo had the highest total among Hawaii County districts, while most (63%) of the crashes on the island of Maui were in the Wailuku district (Figure 87). There were only 8 crashes on the island of Molokai and 2 on Lanai (not shown on the Figure).

Figure 86. Number of EMS-attended pedestrian crashes on Oahu and eastern Oahu (bottom map), by Neighborhood Board, 2007-2011.

(Percent of all EMS-attended crashes in the state is shown in parentheses.)

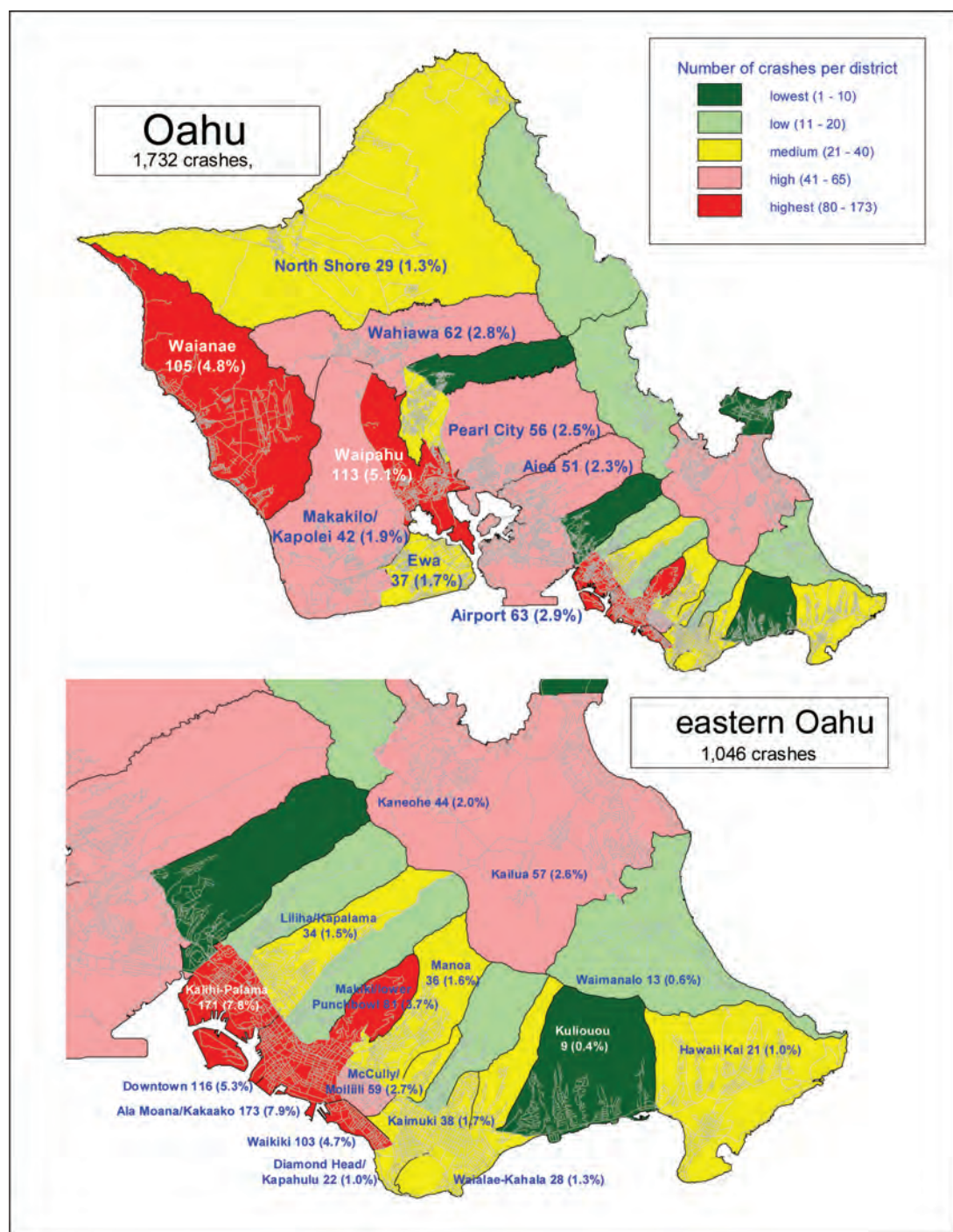
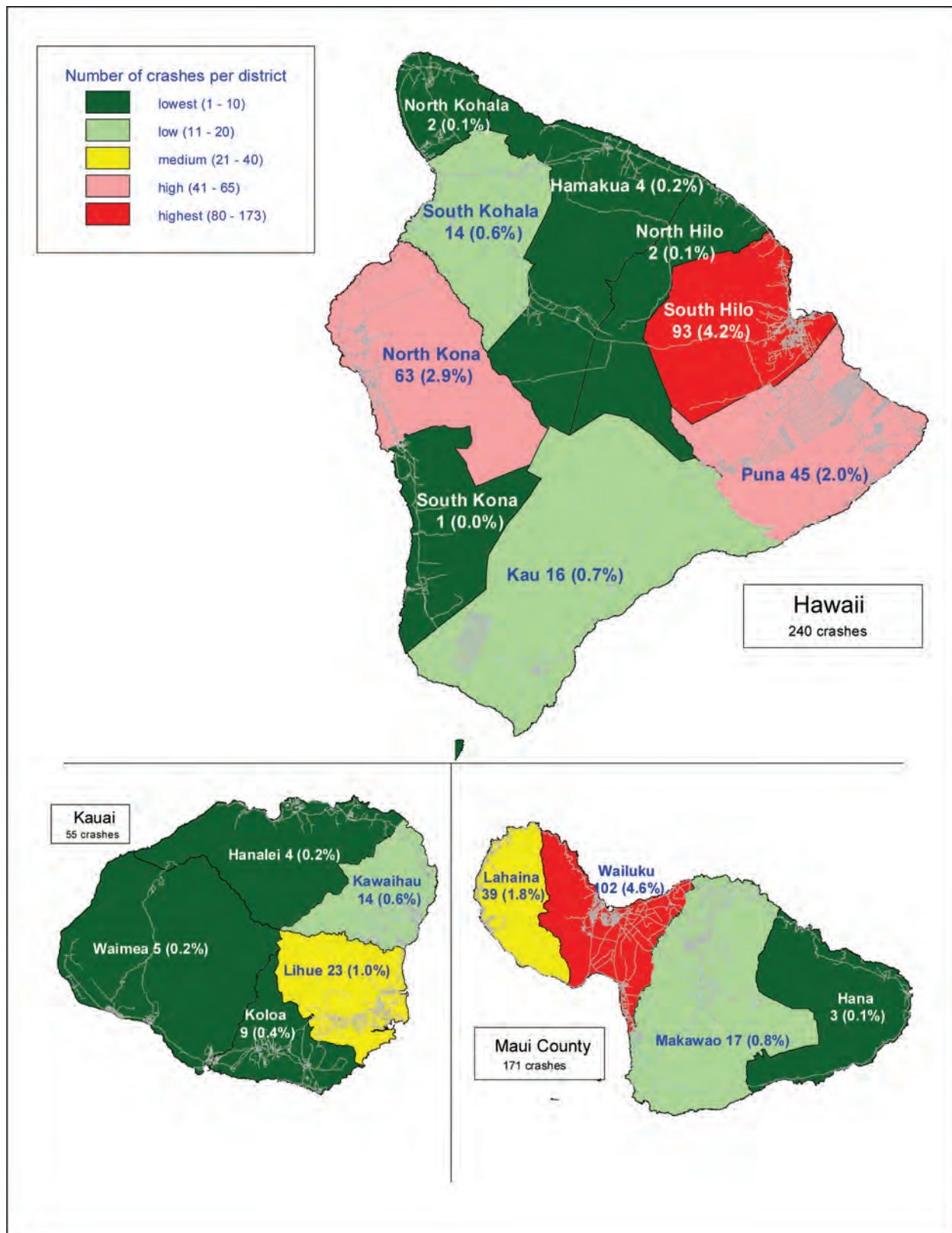


Figure 87. Number of EMS-attended pedestrian crashes on Neighbor Islands, by district, 2007-2011.

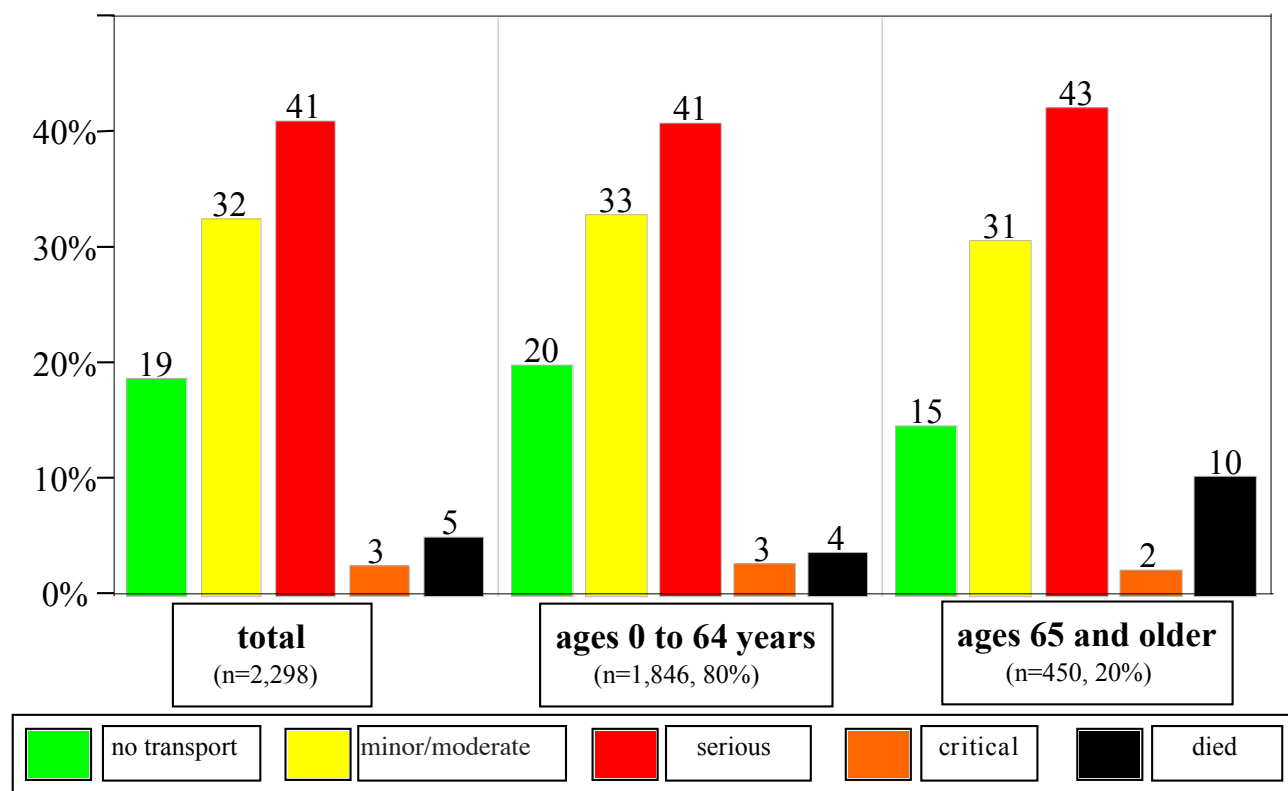
(Percent of all EMS-attended crashes in the state is shown in parentheses.)



About half (51%, or 1187) of the pedestrians either refused EMS transport to hospitals (19%), or were transported with only “minor” or “moderate” injuries (32%) (Figure 88). Another 41% (1670) were transported with “serious” injuries, 61 in “critical” condition, and another 114 who ultimately died. (The latter status included those described as deceased on the scene as well as those linked to death certificates after they were transported to hospitals.)

Patient condition differed by age, as senior-aged pedestrians were significantly less likely to not be transported, compared to pedestrians less than 65 years of age (15% vs. 20%, respectively), and had a significantly higher mortality rate (10.3%, or 47 of 456, vs. 3.6%, or 67 of 1855). The mortality rate was also significantly elevated among pedestrians who were hit during night time hours (7.4%, or 42 of 566), compared to those hit between 5:31 a.m. and 7:29 p.m. (4.1%, or 72 of 1747), despite the younger age distribution among the former. Pedestrians hit on Neighbor Islands had generally worse dispositions compared to those hit on Oahu, with proportionally fewer released at the scene (14%, vs. 20% for Oahu patients), and more who ultimately died (7.6% vs. 4.2%).

Figure 88. Distribution of injury severity/transport status of pedestrians treated by EMS personnel, by age group, 2007-2011.



*Not shown are 15 patients who were transported with injuries of unknown severity.

Probable alcohol use was noted for about 9% of the patients, as EMS personnel documented physical evidence (e.g. containers) at the crash scene, alcohol odor on the patients' breath, or the patient admitted to alcohol consumption (Table 17). This proportion was much higher among pedestrians who were hit on Neighbor Islands (16%) than among those hit on Oahu (7%). There were no differences in average patient age across the groups, but the alcohol users were significantly less likely to be seniors (2%) compared to the others (20% to 22%). They were also more likely to be males, and more likely to have been injured in a night time crash or a crash on the weekend. Patients who had used alcohol had generally worse dispositions, and were more than three times as likely to require transport in critical condition, and nearly twice as likely to have died, compared to those who did not use alcohol.

Table 17. Characteristics of pedestrians treated by EMS personnel, by category of alcohol use, 2007-2011.

	Alcohol use (n=202, 9 %)	No alcohol use (n=1,196, 52 %)	No data/unknown (n=915, 40 %)
Average age	38 years	41 years	41 years
Ages 65 years and older	2%	22%*	20%*
Gender (% male)	76%	51%*	52%*
Disposition			
no transport	10%	19%*	20%*
minor/moderate injuries	20%	36%*	30%
serious injuries	54%	37%*	43%*
critical injuries	5.0%	1.4%*	3.7%
died	10.9%	5.7%*	2.6%*
Weekend crash (Sat/Sunday)	36%	24%*	21%*
Nighttime crash (8 pm - 5 am)	68%	19%*	22%*

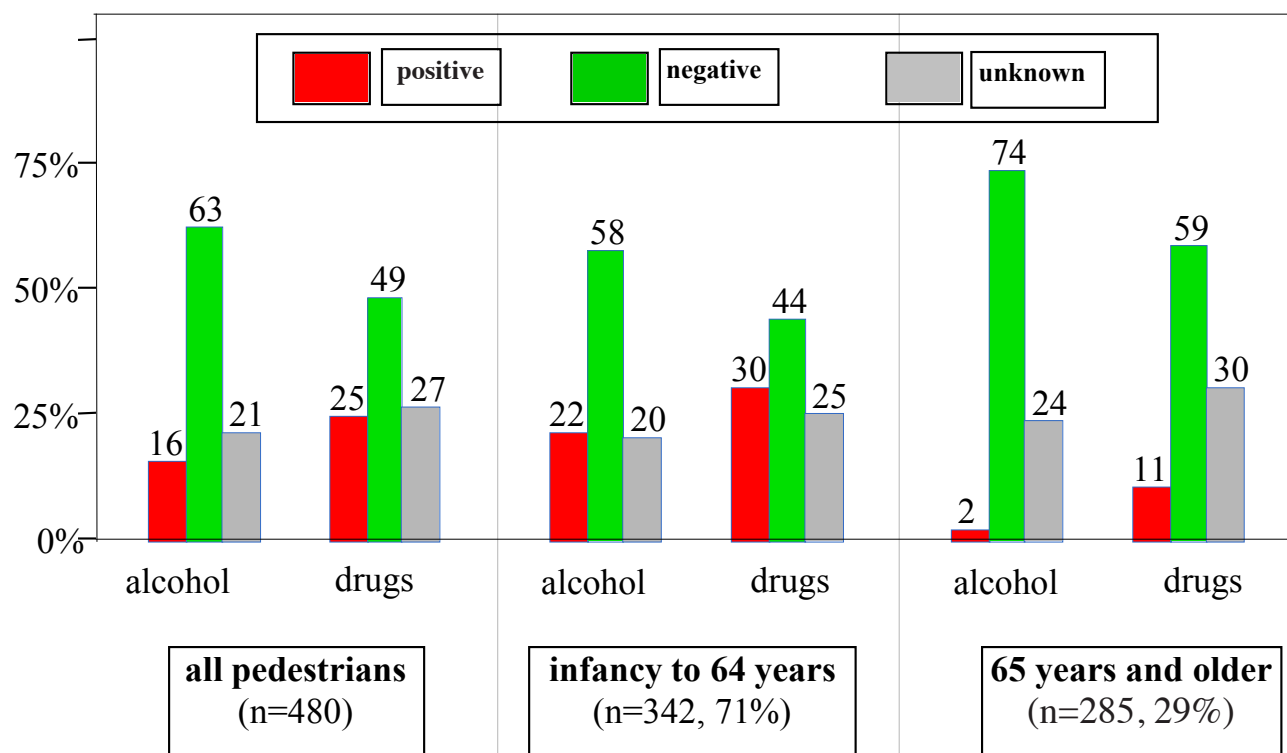
*Indicates statistically significant difference between riders who used alcohol vs. other riders.

Trauma Registry data

Only 16% of the injured pedestrians in the HTR had been drinking at the time they were hit (Figure 89). This percentage was significantly higher among those under 65 years of age (22%), as only 2% (3) of the 138 senior-aged pedestrians tested positive for alcohol. Illicit drug usage was documented for 25% of the patients, including 30% of those who were under 65 years of age. Considered together, about one-third (34%, or 164) of the patients tested positive for either alcohol or drugs, although that proportion was much lower among the senior-aged patients (12%), compared to younger patients (43%). Narcotics were the most commonly found illicit drug (16% of patients), followed by THC (8%), and amphetamines (6%). Most (87%, or 13) of the 15 senior-aged pedestrians who were positive for drugs had used narcotics; less than 2% were positive for THC or amphetamines.

Alcohol use was significantly more likely among the male pedestrians (23%) compared to females (7%), and among those hit on weekends (21% vs. 14% for those hit on weekdays). Alcohol use was nearly 8 times likely among pedestrians hit during night time hours (41%) than among those hit between 6:30 a.m. and 7:29 p.m. (5%). Alcohol use was not significantly associated with final disposition of patients, including the mortality rate.

Figure 89. Alcohol and/or drug use (percent) among pedestrians in the Hawaii Trauma Registry, by age group, 2008-2011.

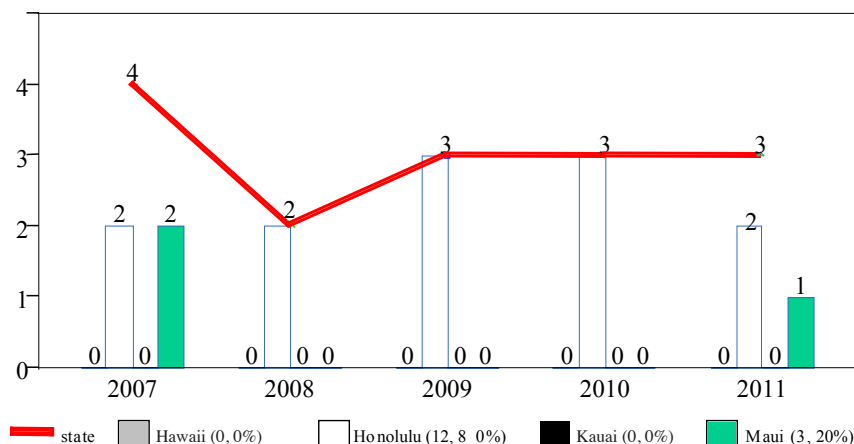


Bicyclists

Fatal injuries

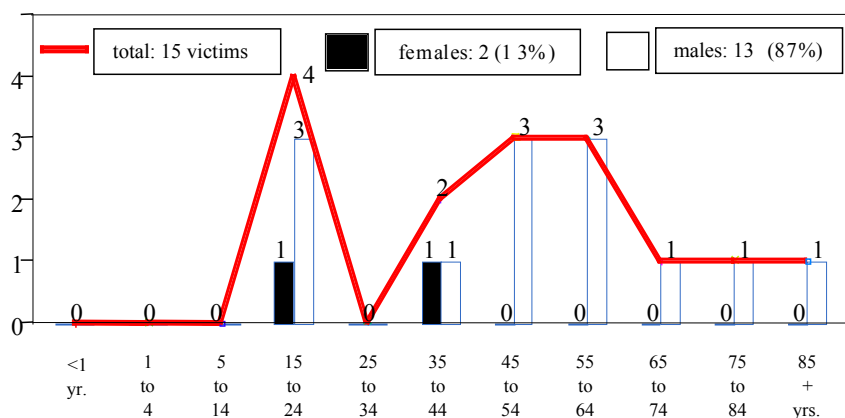
Fatalities among bicyclists were the least common type of fatality from motor vehicle crashes. There were 15 fatalities among resident bicyclists in Hawaii, with the annual total varying between 2 and 4 (Figure 90). Most (80%, or 12) of the victims were injured on Oahu, and the remaining 3 on the island of Maui; there were no deaths on Hawaii or Kauai counties over the 5-year period.

Figure 90. Annual number of bicyclist fatalities among Hawaii residents, by county, 2007-2011.



The age of the victims was broadly distributed over the range of 18 to 86 years (Figure 91). Almost all (87%, or 13) of the victims were males. There were no patterns regarding the month of the crash or the day of the week. About two-thirds (64%, or 9 of 14) of the crashes occurred during daylight hours between 7:31 a.m. to 7:29 p.m., but there were no notable peak times. (This information was missing for 1 crash.)

Figure 91. Age and gender distribution of fatally injured bicyclists in Hawaii, 2007-2011.



Only 2 (13%) of the victims were known to be wearing a helmet at the time of the crash. Eleven (73%) were not wearing a helmet, and this information was missing for the remaining 2 bicyclists.

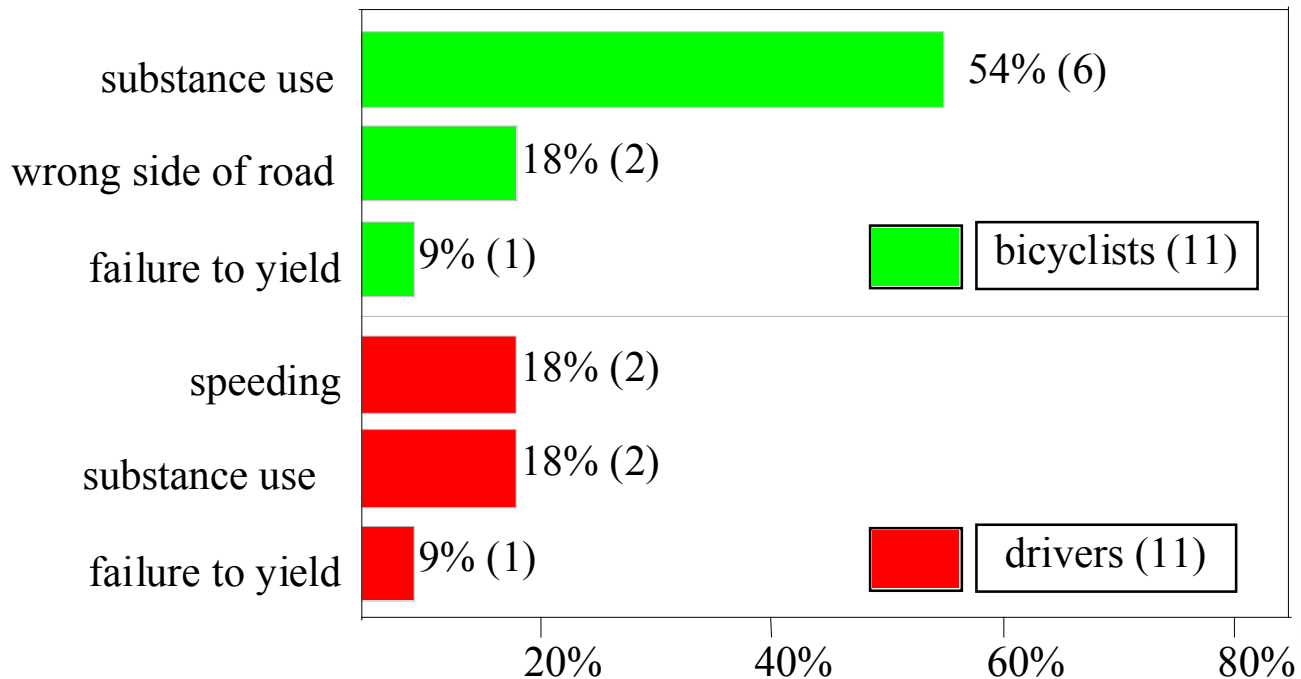
Almost all (13, 87%) of the 15 victims were struck by a motor vehicle. The other bicyclists died as a result of falling off the bicycle. All 11 fatal crashes that involved a motor vehicle from 2007 to 2010 were linked to FARS records. The rest of this section (excluding the maps) will utilize only the data from these 11 deaths.

Most (64%, or 7) of the crashes occurred in a 35 mile per hour zone. One was in a high speed environment (45 mph), and the remaining 3 were in 30 mph or slower zones. Most (64%, or 7) of the crashes occurred on roads with undivided two-way traffic; 3 other crashes were on divided roadways, including 2 on highways, and the remaining crash was on a highway off-ramp. Most (64%, or 7) of the cyclists were hit while on the roadway, with only 2 of those occurring at intersections. Almost all (91%, or 10) of the vehicles involved in the crashes were going straight on the road; 1 vehicle was making a right-hand turn.

Two (18%) of the 11 bicyclists tested positive for alcohol, and 4 (36%) tested positive for drugs, including 2 who had used amphetamines. Overall, about half (54%, or 6) of the victims tested positive for either alcohol or drugs. Only 1 of the 11 drivers involved in the crashes tested positive for alcohol (5 were not tested), and 1 tested positive for drugs (methamphetamine).

Besides substance use among 54% (6) of the bicyclists, 2 were traveling against traffic at the time of the crash and another failed to yield the right-of-way (Figure 92). Four (36%) of the 11 drivers made an error which contributed to the crash, most commonly substance use and speeding (2 instances each).

Figure 92. Contributing factors for fatal bicyclist crashes in Hawaii, by person type, 2007-2010.



The 12 fatal crashes on distributed across 10 districts, with the highest totals (2 deaths each) in the North Shore and Kalihi-Palama districts (Figure 93). There were 3 fatal crashes on the island of Maui, 2 in Wailuku and 1 in Lahaina (Figure 94). There were no fatalities in either Hawaii or Kauai counties over this 5-year period.

Figure 93. Approximate location of fatal bicyclist crashes on Oahu and eastern Oahu (bottom map), 2007-2011.

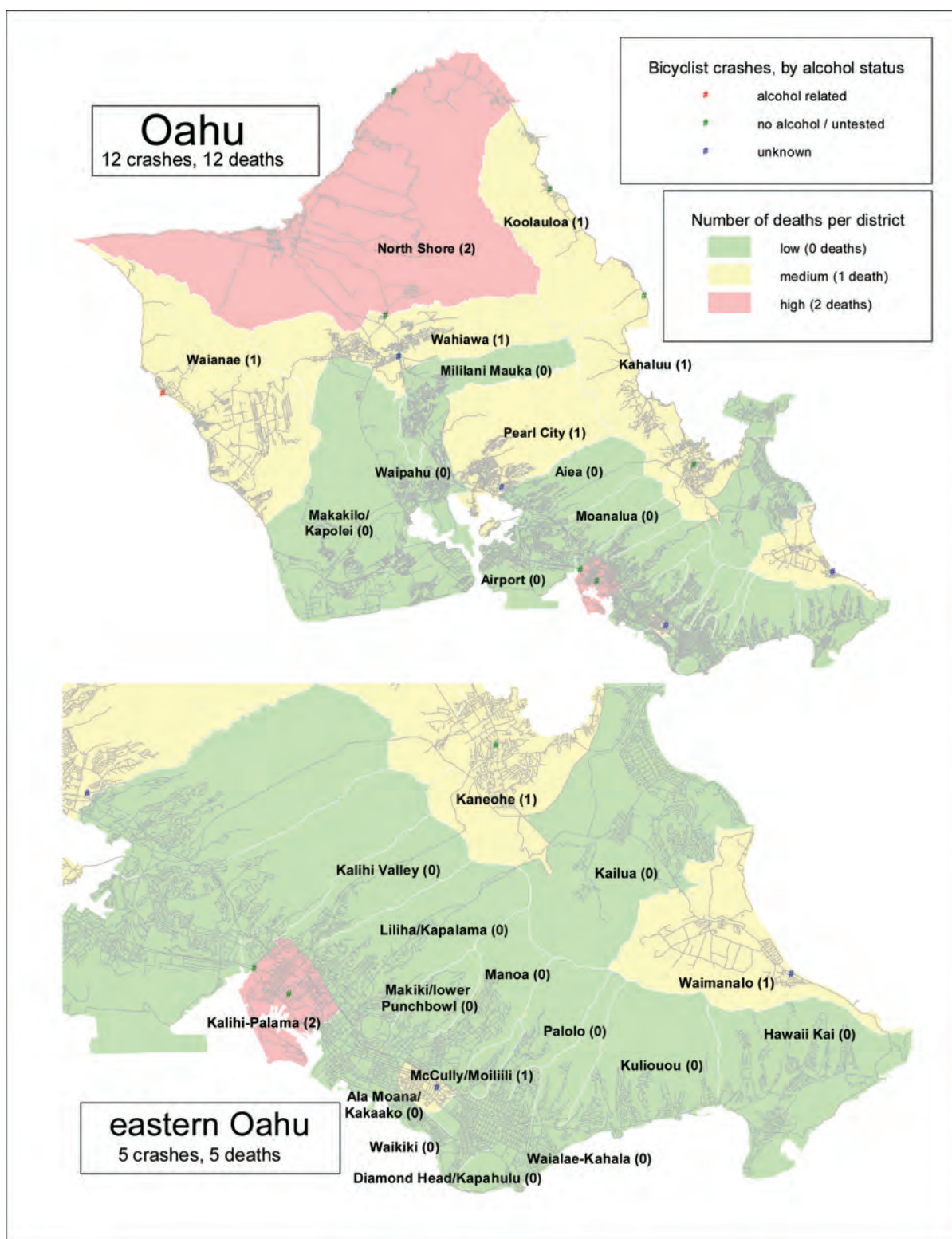
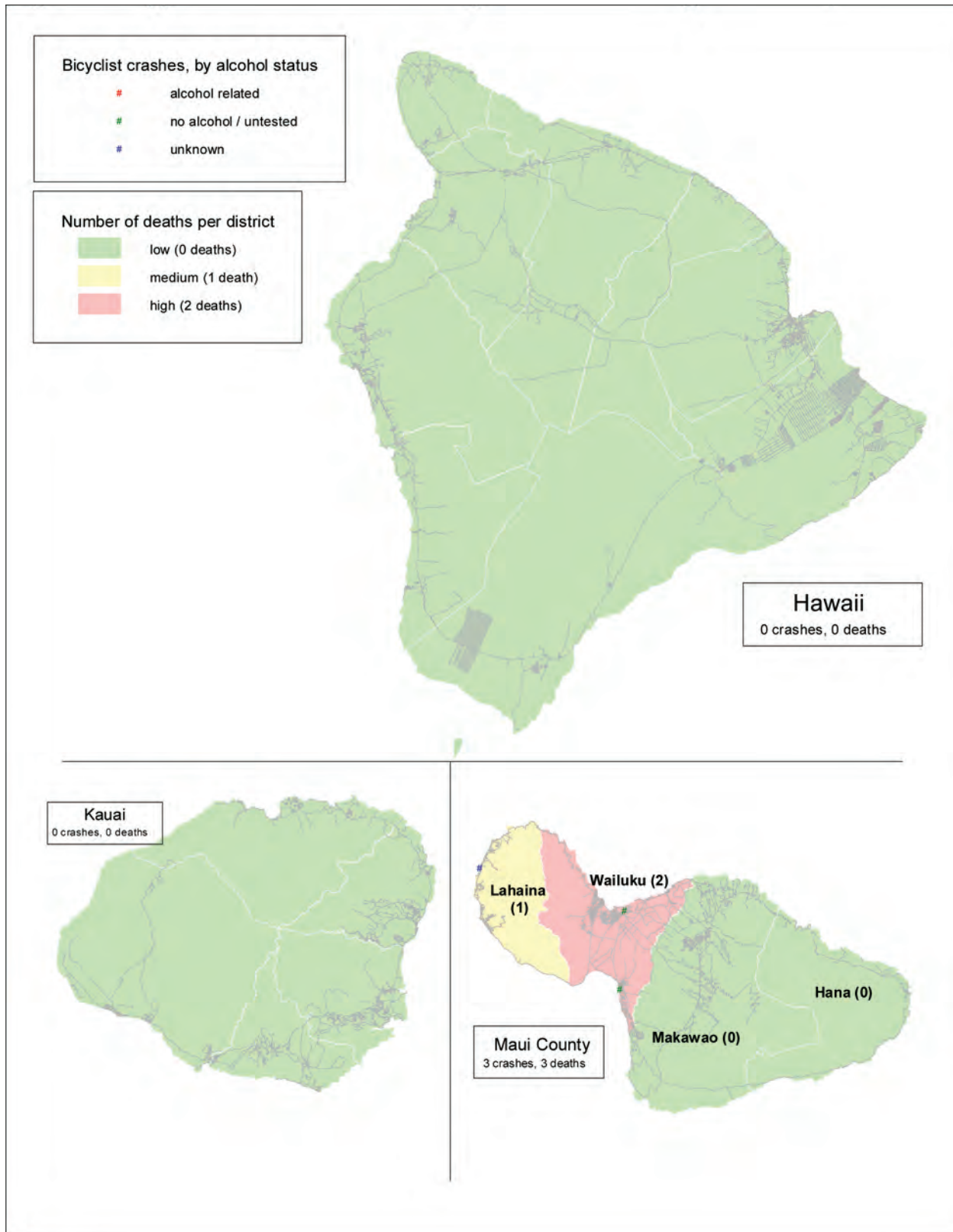


Figure 94. Approximate location of fatal bicyclist crashes on Neighbor Islands, 2007-2011.



Nonfatal injuries

There was a consistent increase in annual number of ED visits for nonfatal injuries among bicyclists over the 2008 to 2011 period (Table 18). There was no apparent trend for the annual number of injuries that required hospitalization. The number of injuries treated in EDs outnumbered those requiring hospitalization by more than a 10-to-1 ratio. Most (75%) of the patients were males, including 80% of those who were hospitalized. Patients who were treated in EDs were significantly younger than those who were hospitalized (average age 27 vs. 39 years, respectively). Almost one-third (32%) of those who were treated in EDs were between 5 and 14 years of age, compared to 20% of those who were hospitalized. Senior residents comprised only about 4% of the patients overall. About two-thirds (63%) of the patients were residents of Honolulu County.

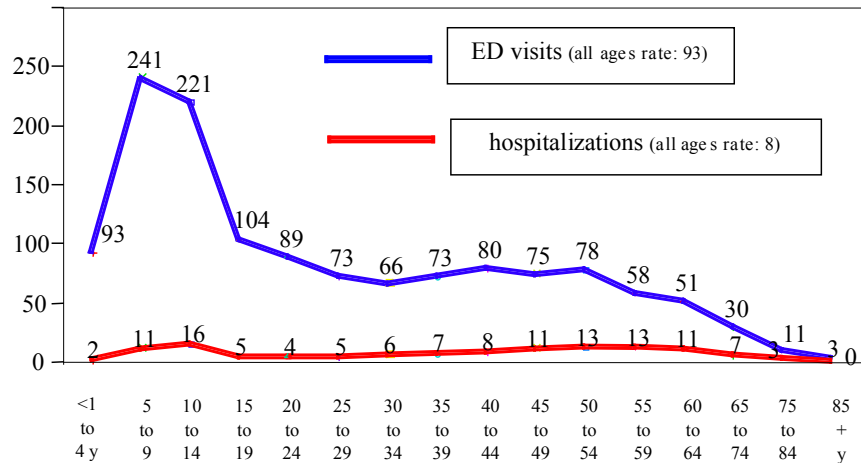
Table 18. Demographic characteristics* of Hawaii residents with nonfatal injuries from bicycle crashes.

	ED visits	hospitalizations	total
Year of admission			
2007	1096	101	1197
2008	1048	121	1169
2009	1091	91	1182
2010	1168	89	1257
2011	1260	121	1381
average annual total	1133	105	1237
Patient gender			
Female	288 (25%)	21 (20%)	309 (25%)
Male	845 (75%)	83 (80%)	928 (75%)
Patient age			
infants	0 (0%)	0 (0%)	0 (0%)
1-4 y	82 (7%)	2 (2%)	84 (7%)
5-14 y	360 (32%)	21 (20%)	381 (31%)
15-24 y	168 (15%)	8 (8%)	176 (14%)
25-34 y	130 (11%)	10 (10%)	140 (11%)
35-44 y	132 (12%)	13 (12%)	144 (12%)
45-54 y	139 (12%)	23 (22%)	162 (13%)
55-64 y	87 (8%)	20 (19%)	106 (9%)
65-74 y	27 (2%)	6 (6%)	33 (3%)
75-84 y	7 (1%)	2 (2%)	9 (1%)
85+ y	1 (0%)	0 (0%)	1 (0%)
County of residence of patient			
Hawaii	185 (16%)	16 (15%)	201 (16%)
Honolulu	715 (63%)	64 (61%)	779 (63%)
Kauai	101 (9%)	8 (8%)	109 (9%)
Maui	131 (12%)	17 (16%)	148 (12%)

*Statistics are annual averages over the 2007-2011 period.

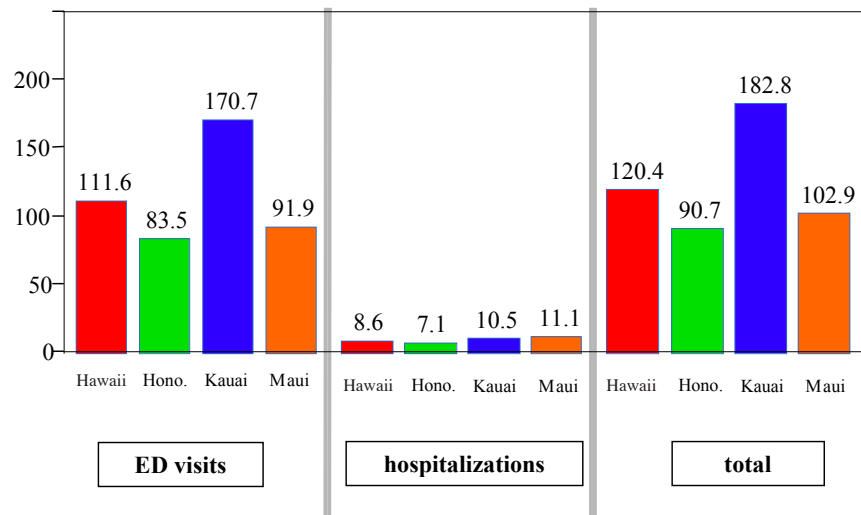
Children aged 5 to 14 years had the highest rates both for injuries treated in EDs and those that required hospitalizations (Figure 95). Combining both types of injuries, rates for 5 to 14 year-olds (244 injuries/100,000 residents) were more than 3 times higher than rates for residents of other ages (74/100,000). Rates for injuries treated at the ED level generally declined among residents aged 50 years and older, while there was a peak in hospitalizations among 45 to 64 year residents.

Figure 95. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for nonfatal injuries from bicycle crashes in Hawaii, by age of patient, 2007-2011.



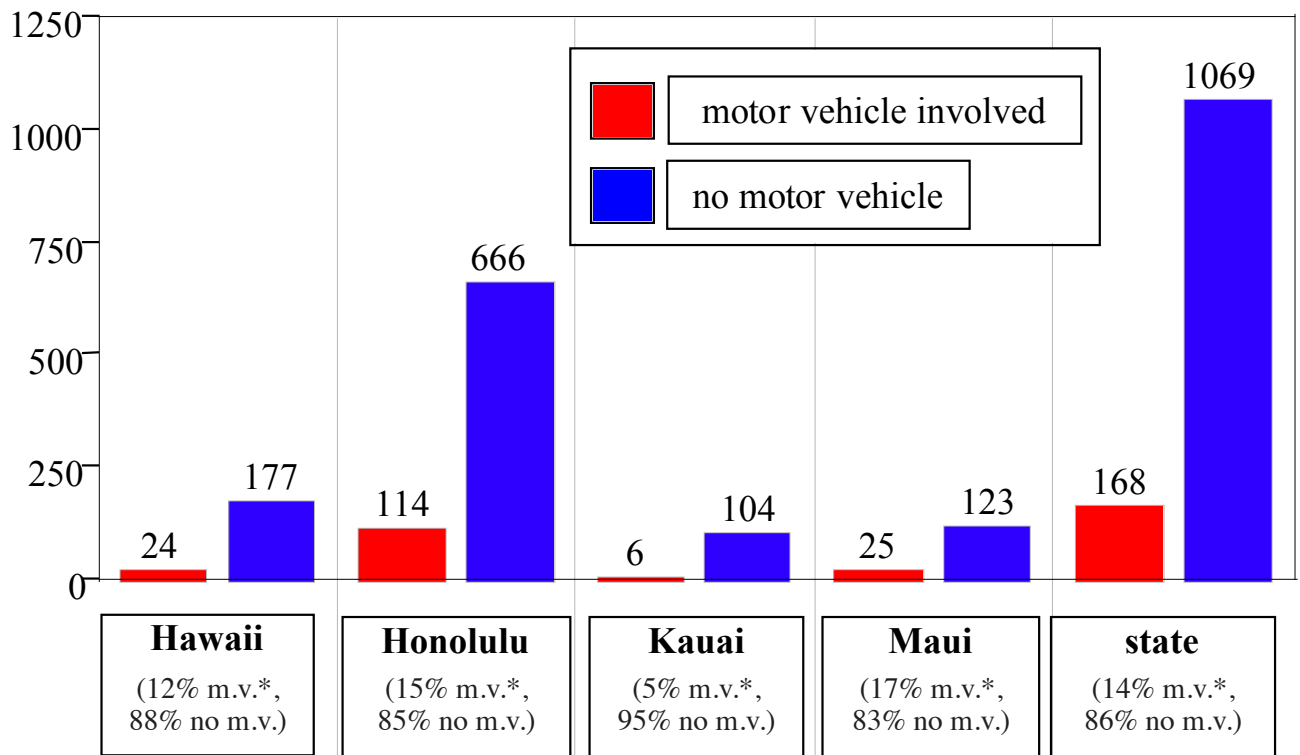
The rate for ED visits for Kauai County residents was significantly higher than the rates for any other county, and approximately double the rate estimates for residents of Honolulu or Maui counties (Figure 96). The rate for Hawaii County residents was also significantly higher than the rates for Honolulu residents, although 35% lower than the rate for residents of Kauai County. Similar relationships were found when comparing rates of all types of injuries (those treated in EDs combined with those requiring hospitalization). There were no significant differences in hospitalization rates between counties.

Figure 96. Age adjusted annual rates (per 100,000 residents) of nonfatal injuries from bicycle crashes, by level of care and county of residence of patient, 2007-2011.



Most (86%) of the injuries resulted from crashes that did not involve a motor vehicle, but were caused by the patient falling off their bicycles or colliding with objects (Figure 97). That proportion was significantly lower among Honolulu and Maui County residents compared to residents of Hawaii or Kauai counties. Proportionally more of the injuries treated in EDs did not involve motor vehicles, compared to crashes requiring hospitalization (88% vs. 71%), perhaps reflecting greater injury severity the latter types of crashes. Forty-percent of the patients who were injured from non-motor vehicle crashes were under 15 years of age, compared to 14% of those who were hit by motor vehicles. Almost all (94%) of the crashes that involved a motor vehicle occurred in traffic environments (i.e. on public roadways).

Figure 97. Average annual number of nonfatal injuries from bicycle crashes in Hawaii, by type of crash and county of residence of patient, 2007-2011.



*m.v. = motor vehicle involved in crash

Although almost all (92%) of the patients were treated in EDs, hospitalizations comprised 32% of the treatment days and 66% of the total medical charges (Table 19). The average hospitalization lasted about 5 days and generated over \$36,000 in medical charges. Most (63%) of the hospitalized patients had fractures, including 15% with skull fractures and 20% with leg fractures. Thirty-eight percent of these patients had a traumatic brain injury, compared to 16% of those treated in EDs. Contusions and superficial injuries (26%) and open wounds (25%) were the most common types of injuries among patients treated in EDs, followed by fractures (23%), most commonly of the arms (11%).

Table 19. Clinical characteristics* of Hawaii residents with nonfatal injuries from bicycle crashes.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	5.1	1.3
Total number of days	1,133	534	1,667
Average charge	\$1,873	\$36,192	\$4,657
Total charges	\$2.1 million	\$3.8 million	\$5.8 million
Primary injury diagnosis			
fractures	255 (23%)	66 (63%)	321 (26%)
fracture of skull	11 (1%)	16 (15%)	28 (2%)
vertebral column	4 (0%)	4 (4%)	8 (1%)
ribs, pelvis or trunk	70 (6%)	11 (10%)	81 (7%)
humerus	19 (2%)	4 (4%)	23 (2%)
lower arm or hand	116 (10%)	10 (10%)	127 (10%)
femur	2 (0%)	9 (9%)	11 (1%)
lower leg or foot	32 (3%)	11 (11%)	44 (4%)
sprains and strains	96 (8%)	0 (0%)	97 (8%)
internal injuries	59 (5%)	29 (27%)	87 (7%)
open wounds	280 (25%)	5 (5%)	285 (23%)
contusion/superficial	289 (26%)	1 (1%)	291 (23%)
other/unspecified	154 (14%)	3 (3%)	157 (13%)
traumatic brain injury (any priority diagnosis)	184 (16%)	39 (38%)	224 (18%)

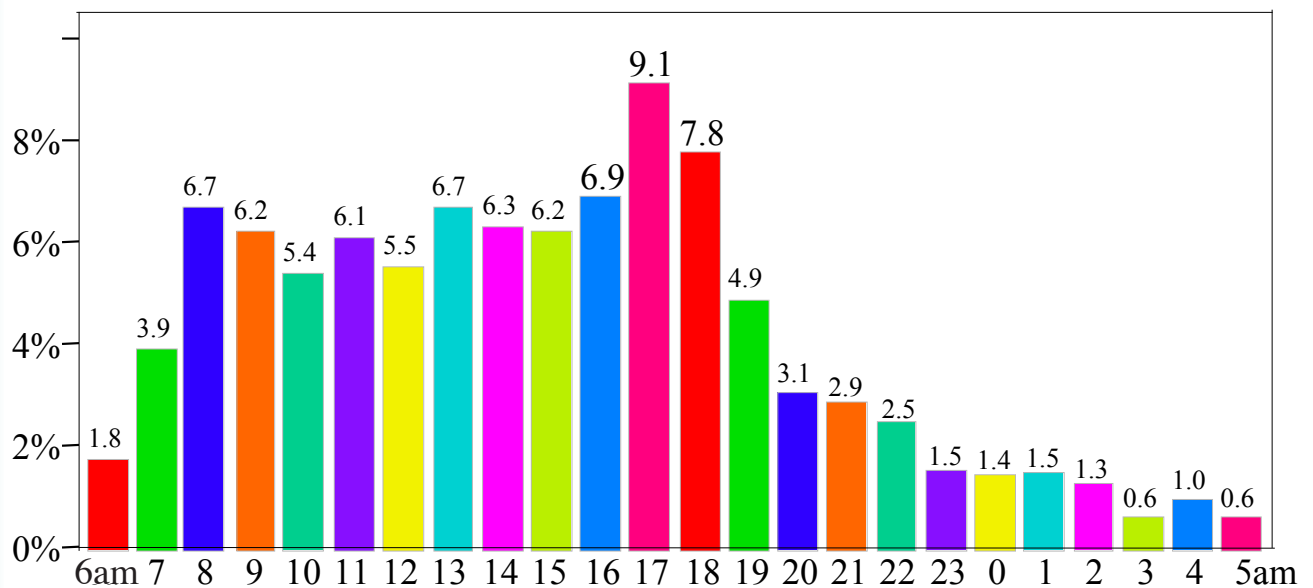
*Statistics are annual averages over the 2007-2011 period.

There were 1,897 EMS records for Hawaii residents who were treated by EMS personnel for occupant injuries over the 2007 to 2011 period. Included in this total were 11 patients who ultimately died from the crashes, since this is an important outcome to examine in terms of helmet usage. (All of these deaths were confirmed by linkage to death certificates.)

The patients were injured in 1,870 separate crashes, as nearly all (99%) crashes involved only a single patient. Most (73%, or 1,366) of the crashes were distributed over the 11-hour period of 7:31 a.m. to 6:29 p.m., with a peak from 4:31 p.m. to 6:29 p.m. (17%, or 318) (Figure 98). This time distribution was similar for crashes that involved motor vehicles and those that only involved bicyclists. Almost one-third (31%, or 583) of the crashes occurred on a weekend, including 17% (311) on Sundays.

Figure 98. Time distribution of EMS-attended bicycle crashes, 2007-2011.

(Horizontal scale indicates time of EMS dispatch, rounded up to nearest hour (military time scale, starting at 6:00am).
Vertical scale indicates percent of all crashes with injured bicyclists, rounded to nearest whole number.)



The 4 highest crash locations on Oahu were in the metropolitan Honolulu area, including 134 in the Ala Moana/Kakaako Neighborhood Board (Figure 99). There were also high numbers in the North Shore and Kailua. South Hilo district had the highest total in Hawaii County, and most of the crashes on the island of Maui were in either Wailuku or Lahaina (Figure 100). There were only 8 crashes on the island of Molokai and 2 on Lanai (not shown on the Figure).

Figure 99. Number of EMS-attended bicycle crashes on Oahu and eastern Oahu (bottom map), by Neighborhood Board, 2007-2011.

(Percent of all EMS-attended crashes in the state is shown in parentheses.)

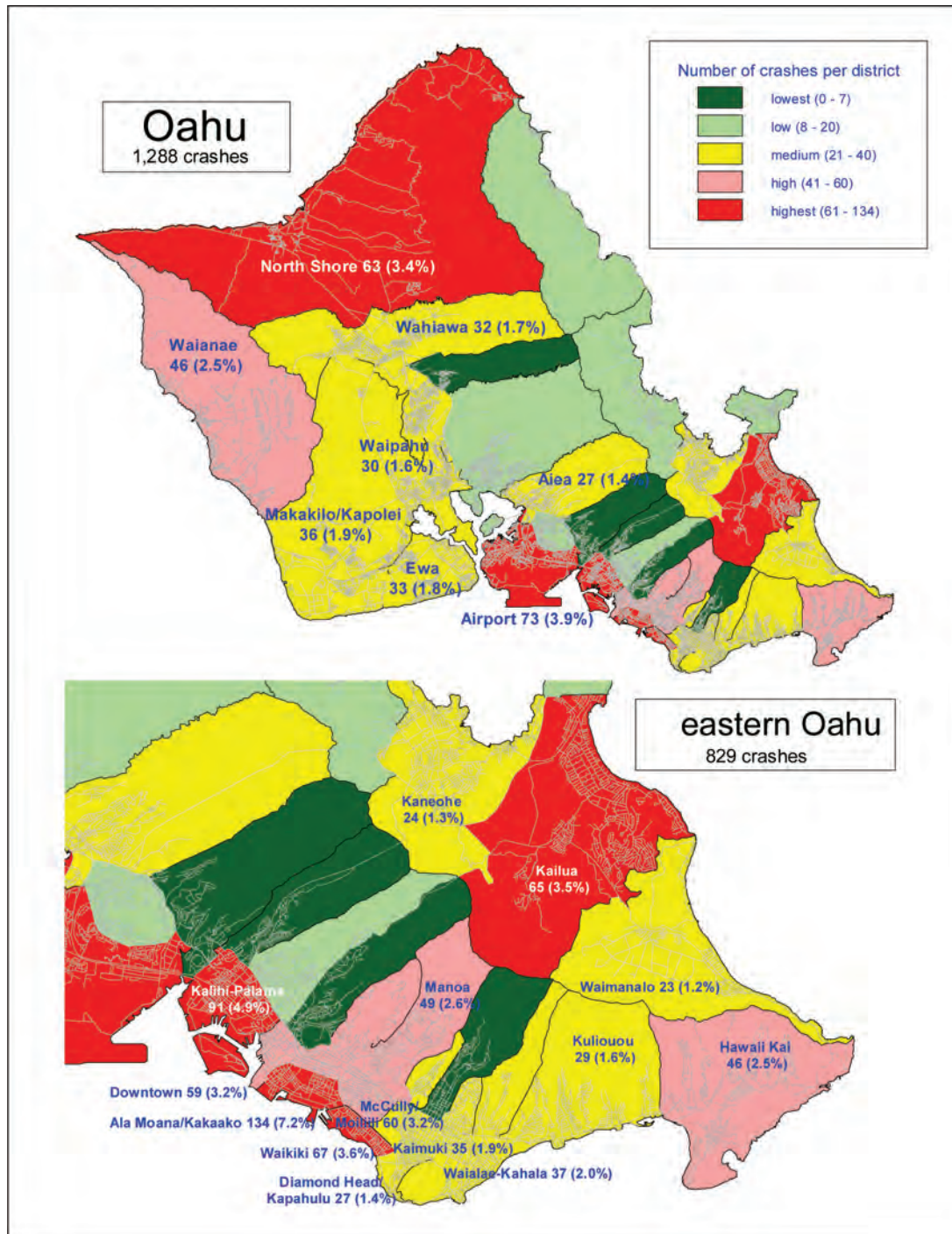
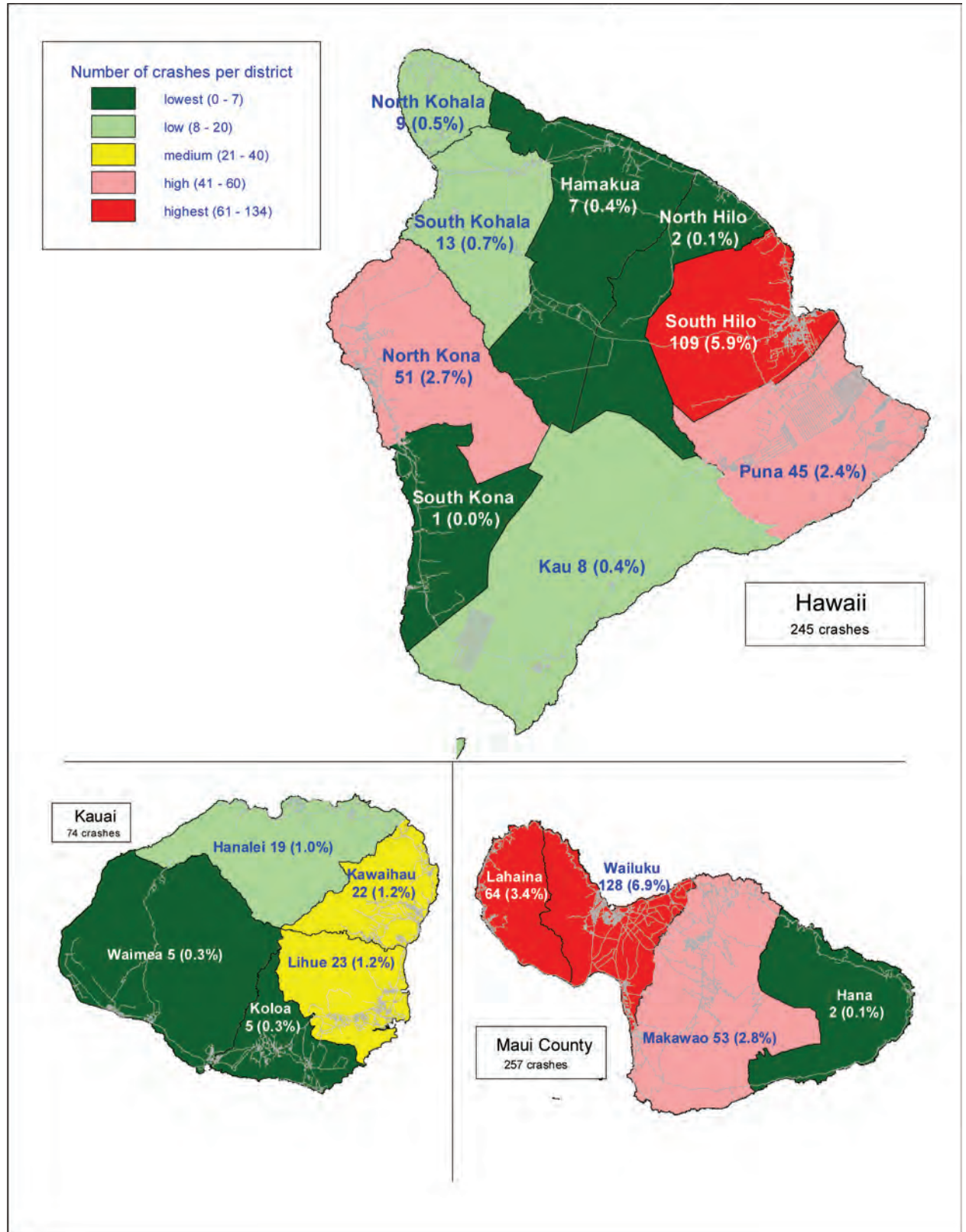


Figure 100. Number of EMS-attended bicycle crashes on Neighbor Islands, by district, 2007-2011.

(Percent of all EMS-attended crashes in the state is shown in parentheses.)

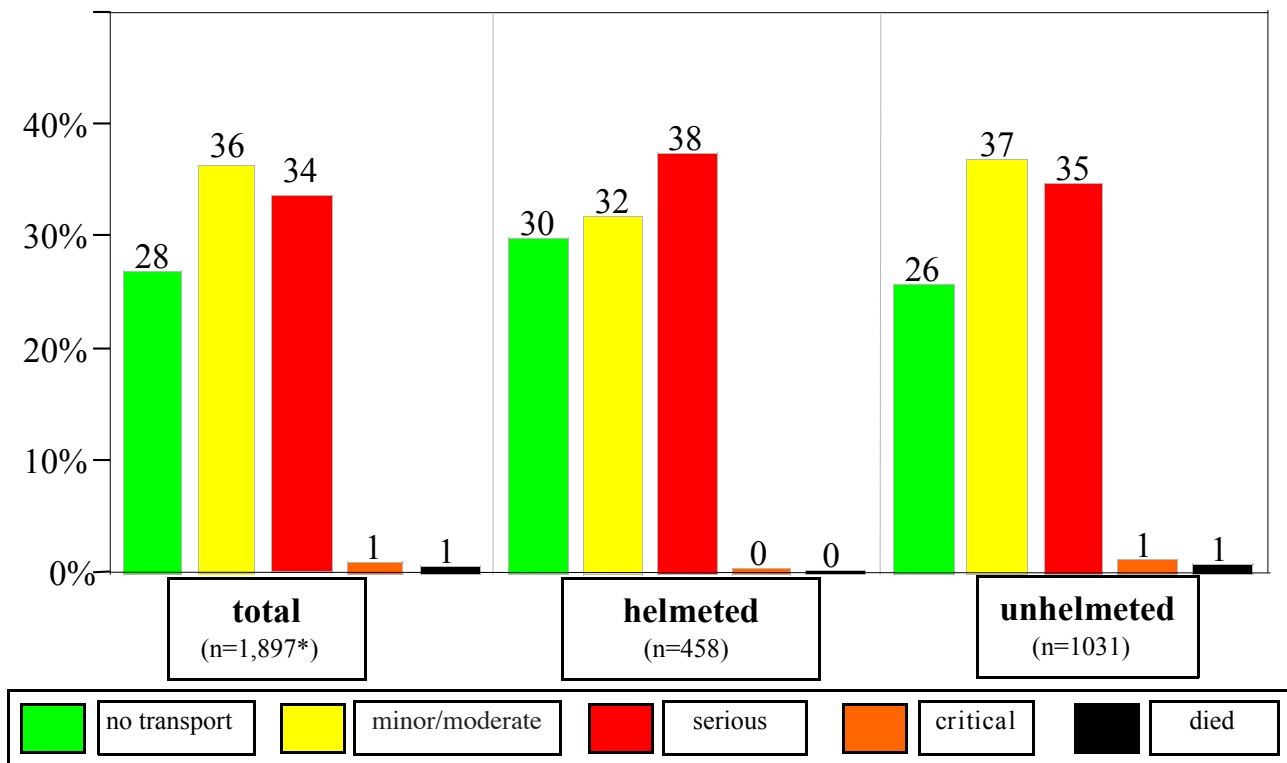


About half (45%, or 856) of the bicyclists were injured in crashes involving a motor vehicle, 29% (554) in crashes involving only bicycles, and 26% (487) in crashes in which this status was not known. Because of software changes, crash type was known for all 1,177 patients injured during the 2009 to 2011 period: 53% of the injuries involved motor vehicles and 47% did not. There was also a significant proportion (22%, or 408) of patients for whom helmet usage was not recorded, although this information was nearly complete for years 2009 and 2010: 27% (187) of the 700 bicyclists wore helmets, 71% (493) did not, and this status was unknown for the remaining 2% (12) of riders. For this 2-year period, helmet usage was more common among bicyclists injured on weekends (33%, vs. 24% for those injured during the week), and in daytime crashes (29% vs. 17%, respectively). Helmeted riders were significantly older (41 years on average, vs. 35 years), and more likely to be female (30%, vs. 23% females among unhelmeted bicyclists).

There were relatively few injuries graded as “critical” (1%, or 18), or which resulted in death (0.6%, or 11) among the injured bicyclists (Figure 101). More than one-quarter (28%) of the patients did not require transport to hospitals, and roughly equal numbers were transported with minor or moderate injuries (36%) or serious injuries (34%). Bicyclists injured in crashes that did not involve motor vehicles were surprisingly less likely to be released at the scene (23%, vs. 32% for those hit by motor vehicles), and more likely to be transported in serious condition (39%, vs. 31%). Crashes involving motor vehicles were significantly more likely to result in fatal injuries (1.2%, or 10 of 856), compared to crashes that only involved bicyclists (0.2%, or 1 of 554), however.

Patient condition was generally comparable between helmeted and unhelmeted bicyclists, except for the most serious injuries. Unhelmeted riders had a significantly higher proportion of “critical” or fatal injuries (2.1%, or 22 of 1031), compared to helmeted riders (0.7%, or 3 of 458). These differences were accentuated among crashes that involved motor vehicles, as the proportion of unhelmeted bicyclists with critical or fatal injuries was 3.1% (17 of 540), compared to 0.9% (2 of 214) among helmeted riders. This difference was only of “borderline” statistical significance, however (p=0.08).

Figure 101. Distribution of injury severity/transport status of bicyclists treated by EMS personnel, by age group, 2007-2011.



*Includes 408 riders with unknown helmet use status.

Probable alcohol use was noted for about 9% of the patients, as EMS personnel documented physical evidence (e.g. containers) at the crash scene, alcohol odor on the patients' breath, or the patient admitted to alcohol consumption (Table 20). Patients who used alcohol were significantly older than other patients and were more likely to be male. Weekend and night time crashes were also more likely among the drinkers. Only 4% of these patients were wearing helmets at the time of the crash, although this status was not known for 32% of these patients. If only the 906 bicyclists with known alcohol and helmet status were considered, helmet use was 5 times higher among those who did not consume alcohol (35%), compared to the drinkers (5%). Patients who had used alcohol had generally worse dispositions, with a significantly lower proportion that were released at the scene and a higher proportion (49%) transported in "serious" condition.

Table 20. Characteristics of bicyclists treated by EMS personnel, by category of alcohol use, 2007-2011.

	Alcohol use (n=171, 9%)	No alcohol use (n=1,033, 54%)	No data/unknown (n=693, 37%)
Average age (years)	42 years	35*	37*
Gender (% male)	86%	74%*	74%*
Helmet usage			
helmeted	4%	27%*	25%*
unhelmeted	64%	49%*	59%
unknown	32%	24%*	16%*
Disposition			
no transport	16%	29%*	30%*
minor/moderate injuries	32%	37%	35%
serious injuries	49%	32%*	33%*
critical injuries	1.2%	0.7%	1.3%
died	1.8%	0.7%	0.1%
Weekend crash (Sat/Sunday)	39%	28%*	34%
Nighttime crash (8 pm - 5 am)	49%	11%*	16%*

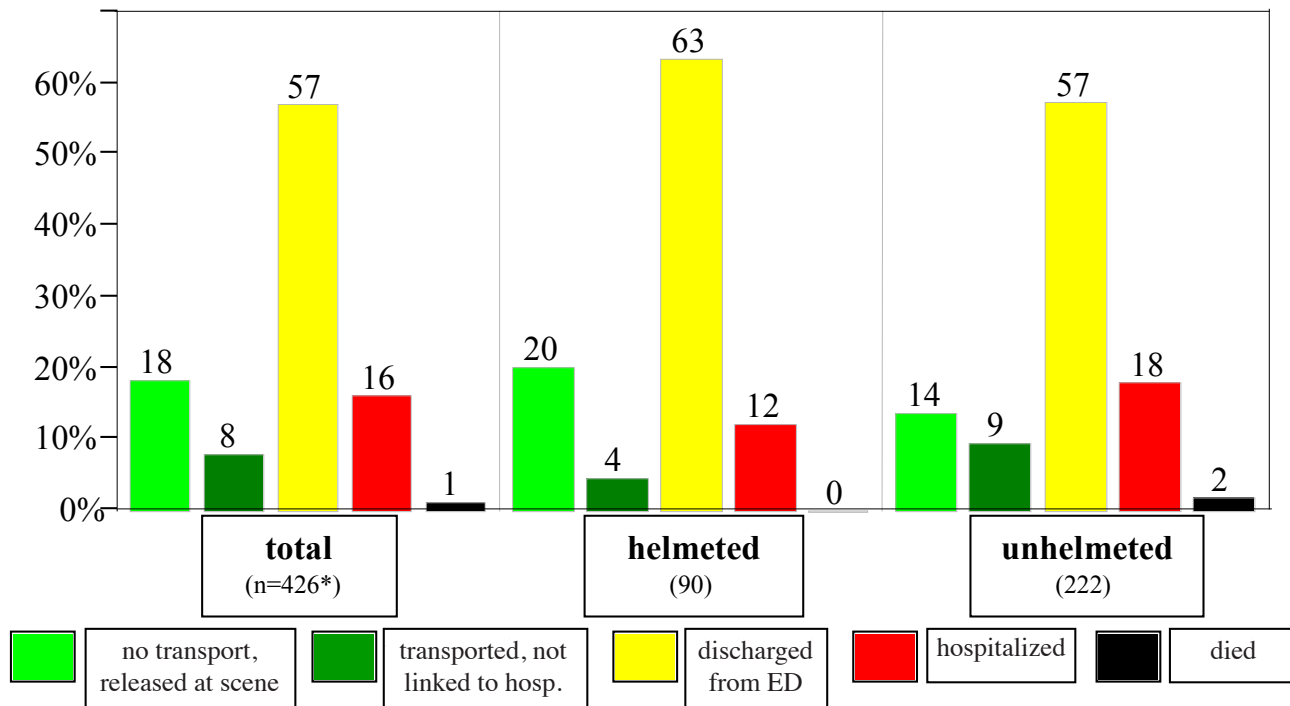
*Indicates statistically significant difference between riders who used alcohol vs. other riders.

This section summarizes results from the 2007 EMS data that was linked to multiple data systems: FARS, death certificates, DOT reports, and hospital records. Only 37% (157) of the 426 EMS records for injured Hawaii residents were probabilistically linked to DOT records, a lower proportion compared to injured occupants (72%, see page 63). This indicates many of these injuries resulted from crashes that did not involve motor vehicles. Hospital records were deterministically linked to 90% (287) of the 319 patients who were transported to hospitals by EMS. Hospital records were also linked to 25 additional EMS patients who refused EMS transport but apparently took private vehicles to hospitals.

Only 21% (90) of the injured bicyclists were known to be wearing helmets at the time of the crash, 52% were not wearing a helmet, and this status was not known for the remaining 27% (114) patients.

About two-thirds (65%) of the bicyclists were eventually discharged from the ED, including 57% for whom ED records could be located (Figure 102). Only 18% were released at the scene, 16% were eventually hospitalized, and 4 (none of whom were wearing helmets) ultimately died from their injuries. Patient disposition was generally better among helmeted bicyclists, as they were more likely to have been released at the scene and less likely to have suffered injuries requiring hospitalization than unhelmeted riders. None of these differences were statistically significant, however. The two groups were also comparable in the incidence of TBI (29% and 28%, respectively), average medical charges, and length of hospitalization. These comparisons are limited, however, by the large proportion (27%) of patients with unknown helmet status and the relatively small sample size, especially for serious injuries.

Figure 102. Final medical disposition of bicyclists treated by EMS personnel, by helmet use, 2007



* Includes 114 riders for whom helmet status was not known.

The odds of sustaining an injury that required hospitalization or resulted in death were 80% higher among unhelmeted riders compared to helmeted riders, although this estimate was only of “borderline” statistical significance ($p=0.11$) (Table 21). (These statistical models did not include the 114 patients with unknown helmet status.) If only crashes that included motor vehicles were included, unhelmeted riders had nearly 4 times (3.7) the odds of a hospitalization or a fatal injury. This estimate was statistically significant, although it was based on only 3 hospitalizations among the helmeted riders and did not include 237 bicyclists (56% of the total) for whom helmet usage or crash type was not known. There was little association between helmet use and the odds of a TBI.

Table 21. Adjusted* odds ratios for adverse medical dispositions among bicyclists treated by EMS personnel, by helmet use, 2007

(Odds ratio 95% confidence intervals given in parentheses.)

	All crashes		Crashes involving motor vehicles	
Restraint group	number (% of group)	odds ratios	number (% of group)	odds ratios
Odds of no transport (released at scene) or discharged from ED, vs. hospital admission or death				
helmeted	44/222 (12%)	1.0 (reference)	3/43 (7%)	1.0 (reference)
unhelmeted	11/90 (20%)	1.8 (0.9 – 4.0)	28/138 (20%)	3.7 (1.2 – 16.4)
Odds of traumatic brain injury				
helmeted	20/68 (29%)	1.0 (reference)	5/31 (16%)	1.0 (reference)
unhelmeted	47/168 (28%)	1.0 (0.5 – 1.9)	25/104 (24%)	1.8 (0.6 – 6.0)

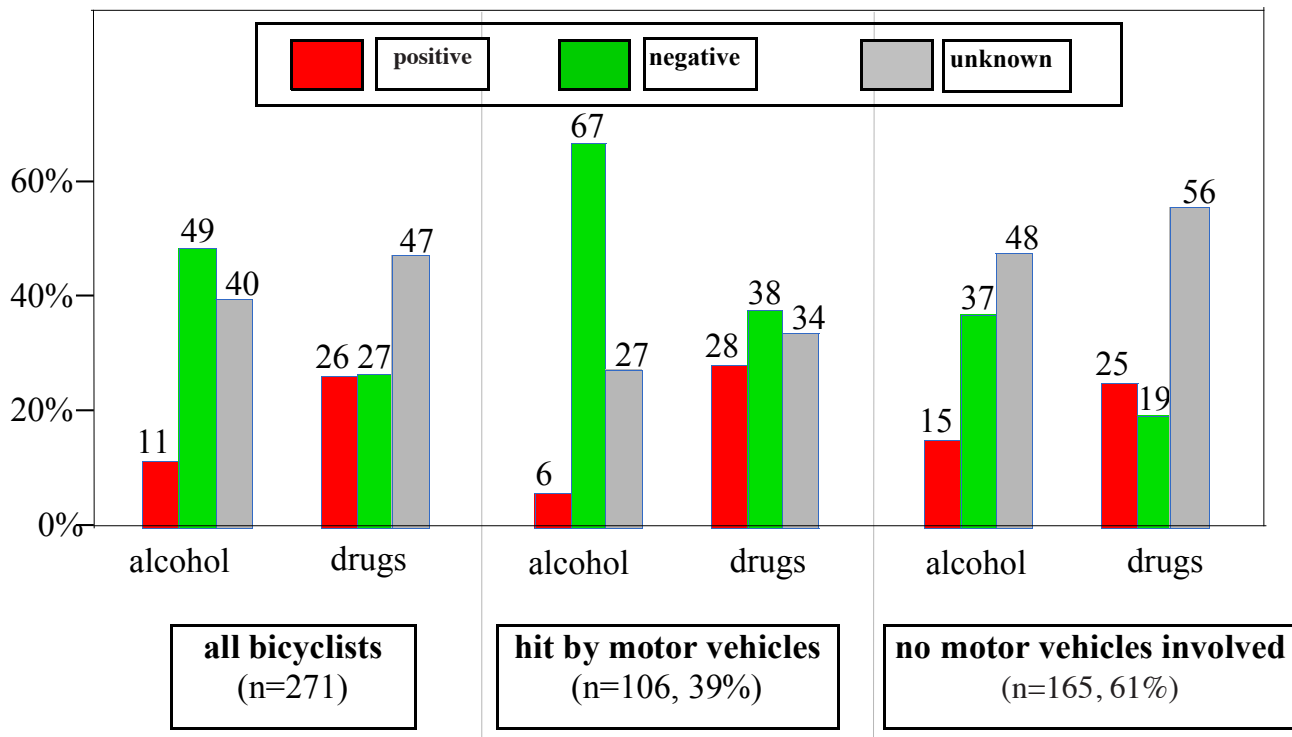
*Adjusted for occupant age, gender, and county in which crash occurred.

Trauma Registry data

Only 11% of the injured bicyclists in the HTR had been drinking at the time they were injured (Figure 103). This percentage was nearly three times higher among those hurt in crashes that did not involve a motor vehicle compared to those who were hit by motor vehicles (15% vs. 6%, respectively). Most (87%, or 27) of the 31 riders who tested positive for alcohol had BAC levels of 0.08% or higher. About one-quarter of the bicyclists tested positive for illicit drugs, and this proportion did not differ by the type of crash. Narcotics were the most commonly found illicit drug (17% of patients), followed by THC (13%), and amphetamines (7%). Overall, one-third (33%, or 89) of the 271 patients tested positive for either alcohol or drugs.

Alcohol use was not significantly associated with patient age, gender, or the day of the week of the injury, but alcohol positive bicyclists were twice as likely to have been hurt during nighttime (55%) compared to non-drinkers (25%). None of the 28 bicyclists who had been drinking were wearing a helmet at the time of the crash, compared to 27% usage among those who tested negative for alcohol, and 31% among those who were not tested. Alcohol use was not significantly associated with final disposition of patients.

Figure 103. Alcohol and/or drug use (percent) among bicyclists in the Hawaii Trauma Registry, by type of crash, 2008-2011.

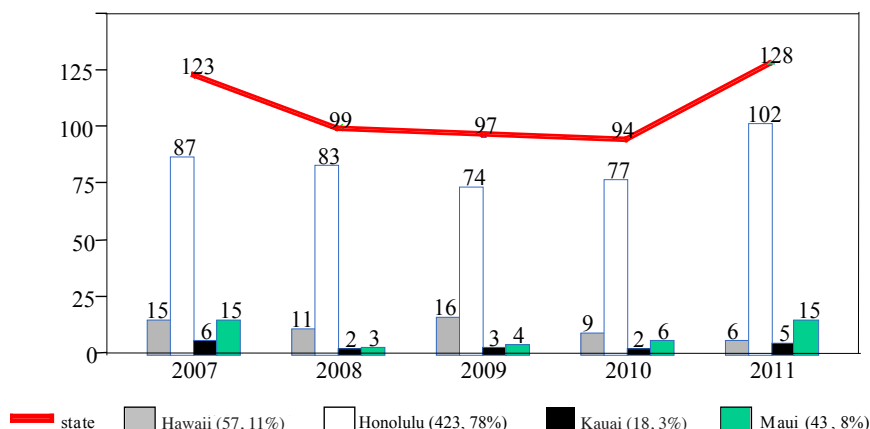


Falls

Fatal injuries

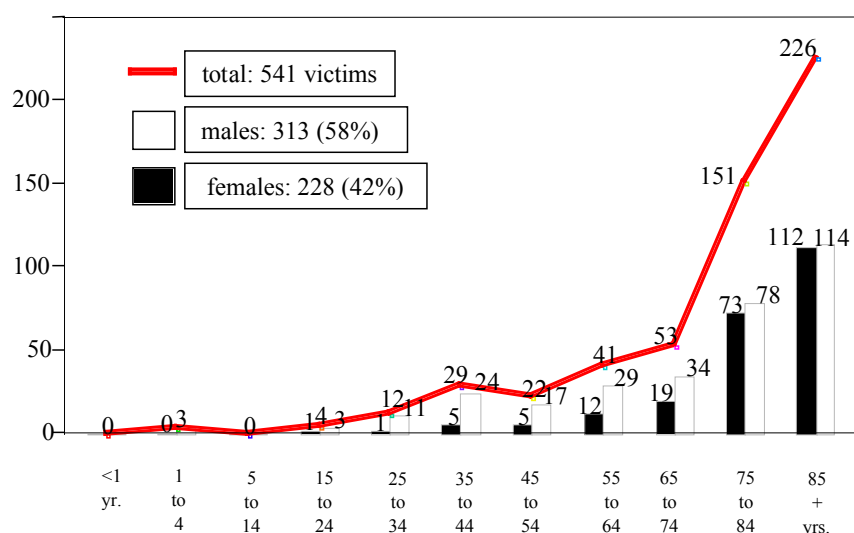
Falls were the most common type of fatal unintentional injury in the state, with the 541 deaths accounting for 25% of the total. There was no clear trend in the annual number of deaths in the state, although the highest level was seen in 2011 (Figure 104). More than three-fourths (78%, or 423) of the injuries occurred on Oahu. About half (48%, or 57) of the 118 fatalities on the Neighbor Islands occurred on the island of Hawaii.

Figure 104. Annual number of fatal falls among Hawaii residents, by county, 2007-2011.



More than three-fourths (79%, or 430) of the falls victims were aged 65 years or older, and 70% (377) were 75 years or older (Figure 105). Male victims outnumbered females overall (58% vs. 42%), but gender was equally distributed among senior-aged victims (226 males and 204 females). In contrast, 78% (87 of 111) of the victims under 65 years of age were males.

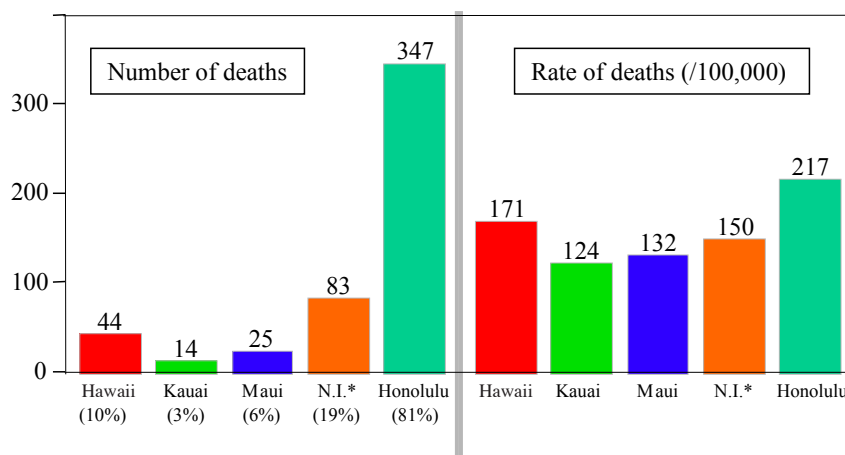
Figure 105. Age and gender distribution of victims of fatal falls in Hawaii, 2007-2011.



Most (81%, or 347) of the 430 senior-aged victims of falls were residents of Honolulu County (Figure 106). The fall fatality rate estimate for senior-aged residents of Honolulu County was significantly higher than the rates for residents of Kauai or Maui counties, and 45% higher than for Neighbor Island residents considered as a whole. Hawaii County residents had the highest rates among the Neighbor Islands, although there were no significant differences among these counties. However, these rate estimates are based on low numbers of deaths, which limits the reliability of statistical comparisons between Neighbor Islands.

Figure 106. Number and rate of fatal falls among senior-aged residents in Hawaii, by county of injury, 2007-2011.

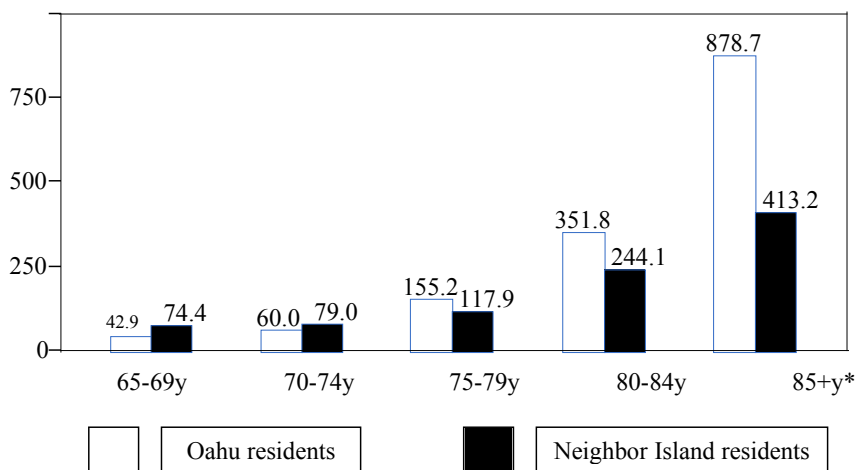
(Rate is per 100,000 senior-aged residents, age adjusted to the 2000 U.S. population distribution.)



*N.I.=Neighbor Islands (combined totals for Hawaii, Kauai, and Maui counties.)

The rate of fatal falls among senior-aged residents increased dramatically with age. For example, the 5-year mortality rate for those aged 85 years or older (758/100,000 residents) was 14 times higher than the rate among 65 to 69 year-olds (53/100,000). The increasing risk across age groups was apparent for senior-aged residents of both Oahu and the Neighbor Islands (Figure 107). However, rates were consistently higher among Oahu residents, including significant differences for residents aged 85 years and older.

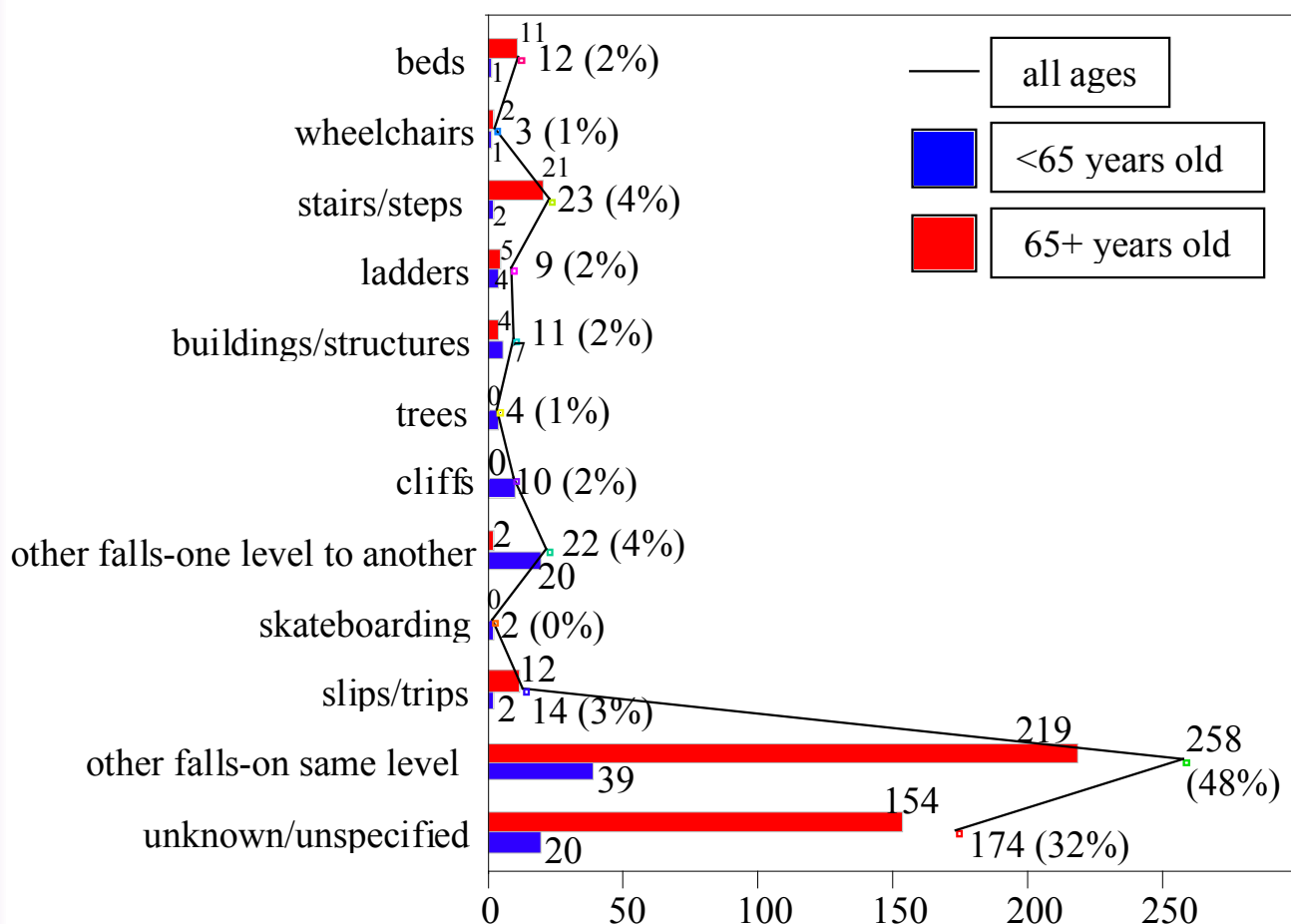
Figure 107. Six-year rates of fatal falls among senior-aged residents of Oahu, and Neighbor Islands, by age group, 2007-2011.



*Indicates statistically significant difference in rate between residents of Oahu and Neighbor Islands.

Figure 108 shows the types of fatal falls, as indicated by coding or the short description from the death certificate. Although there are some specific types of falls listed, the most common causes were vague, including 48% from falls “on the same level” with no further description, and “unspecified” falls (32%). All but 1 of the 12 victims who died from falls involving beds were 65 years or older, and 7 were more than 80 years old. Similarly, seniors comprised most of the victims who fell on stairs or steps (91%), or who fell on the same level from a slip or trip (86%), or other falls on the same level (85%). Most of the victims of falls from cliffs or natural elevations (100%), trees (100%), or other falls from one level to another (91%) were under 65 years of age. Only 1 of the 11 victims who fell from buildings or structures was under 24 years of age.

Figure 108. Fatal falls among Hawaii residents, by type of fall and age of victim, 2007-2011.



Sixty-one percent (327) of the 541 falls occurred in the home of the victim (323 falls) or their residential institution (4 falls). This proportion was higher among the senior-aged victims (68%), compared to those under the age of 65 (32%). The falls occurred fairly evenly over the days of the week. There were also no clear trends across the months of the year. These temporal descriptions were similar when based only on fatal falls among victims aged 65 years and older.

Nonfatal injuries

There was an increasing trend in the number of nonfatal injuries from falls that were treated in EDs, but no clear trend in the annual number of hospitalizations (Table 22). There was an average of nearly 21,000 of the former and over 2,700 of the latter types of injuries each year among Hawaii residents. Gender was equally distributed among patients treated in EDs, but females comprised 59% of the patients that were hospitalized. About two-thirds (68%) of the patients who were hospitalized were 65 years or older, compared to only 26% for those who were discharged from EDs. About two-thirds of the patients treated in EDs (64%) and admitted to hospitals (69%) were residents of Honolulu County.

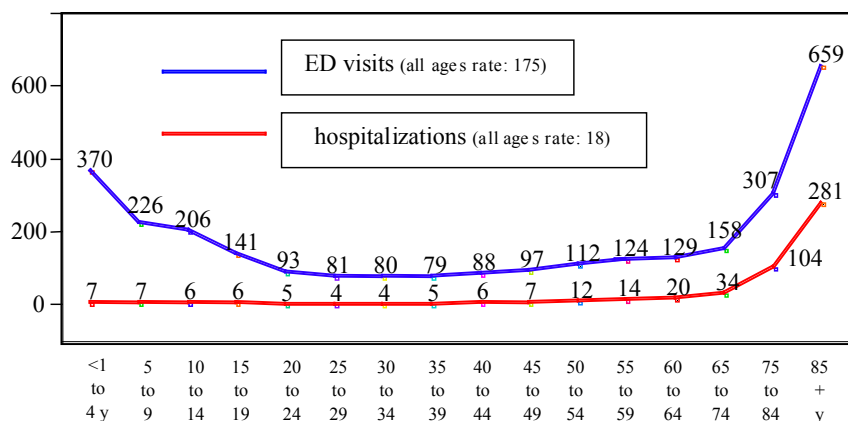
Table 22. Demographic characteristics* of Hawaii residents with nonfatal injuries from falls.

	ED visits	hospitalizations	total
Year of admission			
2007	19,618	2,651	22,269
2008	20,263	2,763	23,026
2009	21,333	2,708	24,041
2010	21,440	2,716	24,156
2011	21,946	2,688	24,634
average annual total	20,920	2,705	23,625
Patient gender			
Female	10,428 (50%)	1,608 (59%)	12,036 (51%)
Male	10,492 (50%)	1,097 (41%)	11,589 (49%)
Patient age			
infants	474 (2%)	14 (1%)	489 (2%)
1-4 y	2,772 (13%)	49 (2%)	2,821 (12%)
5-14 y	3,382 (16%)	105 (4%)	3,487 (15%)
15-24 y	2,028 (10%)	92 (3%)	2,120 (9%)
25-34 y	1,495 (7%)	73 (3%)	1,568 (7%)
35-44 y	1,438 (7%)	88 (3%)	1,526 (6%)
45-54 y	1,907 (9%)	181 (7%)	2,089 (9%)
55-64 y	1,993 (10%)	267 (10%)	2,260 (10%)
65-74 y	1,431 (7%)	313 (12%)	1,744 (7%)
75-84 y	2,034 (10%)	686 (25%)	2,720 (12%)
85+ y	1,966 (9%)	837 (31%)	2,803 (12%)
County of residence of patient			
Hawaii	3,908 (19%)	381 (14%)	4,289 (18%)
Honolulu	13,342 (64%)	1,867 (69%)	15,209 (64%)
Kauai	1,613 (8%)	137 (5%)	1,750 (7%)
Maui	2,057 (10%)	320 (12%)	2,377 (10%)

*Statistics are annual averages over the 2007-2011 period.

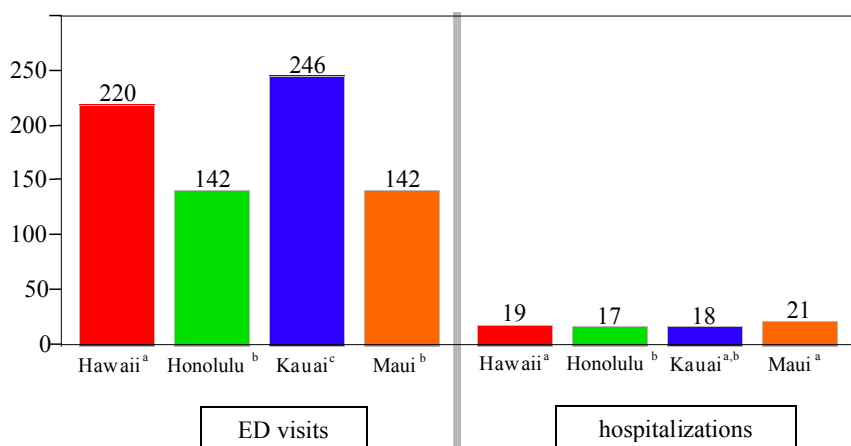
The youngest (ages 14 and younger) and oldest (65 and older) Hawaii residents had the highest rates of nonfatal injuries from falls that were treated in EDs (Figure 109). Rates decreased progressively from residents aged 4 years and younger to 20 to 24 year-olds, then rose gradually over the 25 to 64 year age range before increasing dramatically at ages 65 and older. Rates of ED visits for residents aged 85 and older were 4 times those for 65 to 74 year-olds, and 5 to 8 times higher than rates for other adult-aged residents. There was no peak in hospitalization rates for young children, although children under 10 years of age had the highest rates over the infant to 44 year age range. Rates again increased greatly among senior-aged residents, being at least 14 times higher among those aged 85 years or older compared to residents aged 64 years or younger. Hospitalization rates also increased sharply across the senior age range, approximately tripling across the age groups listed in Figure 85.

Figure 109. Average annual rates (per 10,000 residents) of hospitalizations and ED visits for nonfatal injuries from falls in Hawaii, by age of patient, 2007-2011.



Rates of ED visits among residents of Hawaii and Kauai counties were significantly higher than the rates computed for Honolulu and Maui county residents (Figure 110). Residents of Honolulu County had the lowest rates of hospitalizations, significantly lower than the rate computed for residents of Hawaii County.

Figure 110. Age adjusted annual rates (per 10,000 residents) of nonfatal injuries from falls, by level of care and county of residence of patient, 2007-2011.



(Counties with the same superscripted letter have statistically comparable estimates.)

The causes of the nonfatal falls are shown in Table 23. The distribution of the causes was generally similar for injuries treated in EDs and those that required hospitalization, with somewhat vague causes (e.g. falls “on same level”, and “other”) being the most common. Among the more specifically coded injuries, the most common causes were falls from stairs, steps and escalators (5.3% of the total), beds (3.7%), skateboards (3.5%), and chairs, playground equipment, and ladders (about 2% for each).

Nearly half of the records from ED visits (48%) and over one-third of the hospitalizations (35%) contained no information on where the injury occurred. The most commonly documented places were in the home (26% of ED records, 46% of hospitalizations). About 6% of the ED records were coded for injuries in public buildings, and 6% in recreational sites, while 4% of hospital admission records were coded for injuries in public buildings. Injuries to senior-aged patients were more likely to occur in their home or residential institution (39%), compared to injuries among younger patients (24%). At least half (53%) of the falls that caused hospitalizations in seniors occurred in home environments. This proportion increases to 84% if only records with specific information on location are considered.

Table 23. Causes of nonfatal falls among Hawaii residents, by level of care, 2007-2011.

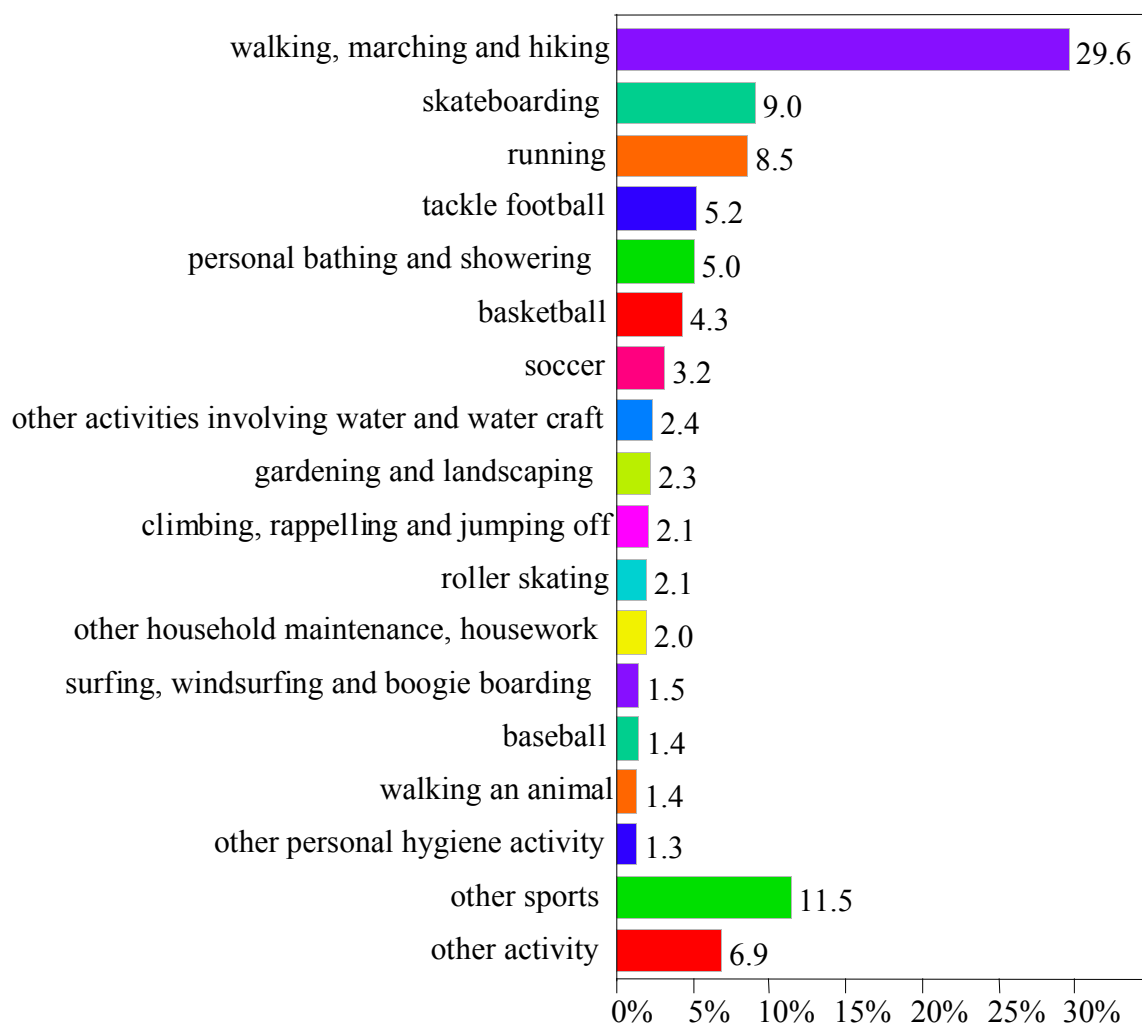
Cause of fall	Annual number of injuries (percent of total)		
	ED visits	hospitalizations	total
sidewalk curbs	116 (0.6%)	11 (0.4%)	126 (0.5%)
stairs, steps, escalators	1111 (5.3%)	136 (5%)	1247 (5.3%)
ladders	395 (1.9%)	72 (2.7%)	467 (2%)
scaffolding	27 (0.1%)	9 (0.3%)	36 (0.2%)
buildings/structures	182 (0.9%)	60 (2.2%)	242 (1%)
cliffs/natural elevations	25 (0.1%)	12 (0.5%)	37 (0.2%)
diving into water	86 (0.4%)	8 (0.3%)	94 (0.4%)
playground equipment	447 (2.1%)	27 (1%)	473 (2%)
chairs	476 (2.3%)	45 (1.7%)	521 (2.2%)
wheelchairs	119 (0.6%)	22 (0.8%)	142 (0.6%)
beds	783 (3.7%)	83 (3.1%)	866 (3.7%)
toilets	36 (0.2%)	11 (0.4%)	46 (0.2%)
other furniture	196 (0.9%)	13 (0.5%)	209 (0.9%)
into holes/openings	121 (0.6%)	5 (0.2%)	126 (0.5%)
from other heights	1255 (6%)	137 (5%)	1392 (5.9%)
razor scooters	106 (0.5%)	3 (0.1%)	109 (0.5%)
roller skates	56 (0.3%)	2 (0.1%)	59 (0.2%)
skateboards	783 (3.7%)	52 (1.9%)	835 (3.5%)
in sports	635 (3%)	18 (0.7%)	653 (2.8%)
on same level (other)	6364 (30.4%)	785 (29%)	7149 (30.3%)
other types of falls	4682 (22.4%)	589 (21.8%)	5271 (22.3%)
unspecified/unknown	2920 (14%)	605 (22.4%)	3525 (14.9%)

Beginning in 2010, some hospitals started providing external cause status codes and activity codes. Only about 5% of the 14,365 records with specific information indicated the patient was injured in a fall from an “activity done for income or pay”.

Information on patient activity was available for about 18% (9,185) of the 48,790 records from 2010 to 2011. Activity codes were more likely to be provided in ED records (19%) compared to inpatient records (9%). This proportion also varied across hospitals, with those in Hawaii County being most likely to provide activity codes (24% of records), and hospitals in Maui County being least likely (15%). (Activity codes were provided for 20% of the records from Kauai County hospitals and 17% of the hospitals on Oahu.) One-third (4 of 12) of the hospitals on Oahu essentially did not provide activity codes in their records.

The most common activity related to the falls was “walking, marching and hiking”, accounting for 30% of the total (Figure 111). (E-codes indicated that most (73%) of these falls occurred in residences (45%), public buildings (13%), roadways (12%), or industrial areas (3%). Relatively few can therefore be assumed to be related to hiking.) Skateboarding, running, tackle football, and bathing and showering were also prominent activities. Activities related to sports (excluding walking and running) accounted for 36% of the total number of falls. That proportion was much lower among senior-aged patients (3%), compared to younger-aged patients (45%). Nearly two-thirds (65%) of the senior-aged patients fell while “walking marching and hiking”. Other common activities among senior-aged patients were gardening and landscaping (7%), bathing and showering (6%), and other activities related to personal hygiene (5%).

Figure 111. Activity of patients injured in nonfatal falls in Hawaii, 2010-2011



*Includes only hospital records with specific Activity codes, approximately 18% (9,185) of 48,790 total records for 2010 through 2011. Codes were more likely to be present in ED records (19%) compared to inpatient records (9%).

Although ED visits for nonfatal falls outnumbered hospitalizations by more than 7-to-1, ED visits only accounted for 55% of the total number of patient days (Table 24). This was because many of the hospitalizations involved long stays; almost one-third (31%) of the patients were hospitalized for 1 week or longer, and 8% for 2 weeks or more. Long stays also increased the average charge per hospitalization to over \$31,000, and the total costs to approximately \$84 million per year, over twice the cost of ED visits (\$34.1 million).

Fractures were by far the most common type of injury among residents hospitalized from nonfatal falls, present in nearly three-fourths (74%) of the patients. About one-third (32%) had fractures of the femur (including 29% with fractures of the neck of the femur), and 10% fractures of the lower leg or foot. Most of the other patients were hospitalized for internal injuries (19%). There was a different pattern for injuries treated in EDs, as about half were contusions or superficial injuries (24%), or open wounds (20%). About a quarter (23%) of the patients had fractures, most commonly the lower arm or hand (9%). About one-fourth (24%) of the hospitalized patients had TBI, compared to 18% among those treated in EDs. (TBI counts included diagnoses of any priority.)

Table 24. Clinical characteristics* of Hawaii residents with nonfatal injuries from falls.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	6.4	1.6
Total number of days	20,920	17,273	38,193
Average charge	\$1,628	\$31,078	\$4,934
Total charges	\$34.1 million	\$84.1 million	\$116.6 million
Primary injury diagnosis			
fractures	4740 (23%)	2012 (74%)	6752 (29%)
fracture of skull	196 (1%)	156 (6%)	352 (1%)
vertebral column	263 (1%)	249 (9%)	512 (2%)
ribs, pelvis or trunk	710 (3%)	210 (8%)	920 (4%)
humerus	599 (3%)	136 (5%)	735 (3%)
lower arm or hand	1983 (9%)	120 (4%)	2103 (9%)
femur	53 (0%)	875 (32%)	928 (4%)
lower leg or foot	935 (4%)	266 (10%)	1201 (5%)
sprains and strains	2656 (13%)	30 (1%)	2685 (11%)
internal injuries	754 (4%)	509 (19%)	1263 (5%)
open wounds	4247 (20%)	42 (2%)	4288 (18%)
contusion/superficial	5009 (24%)	47 (2%)	5056 (21%)
other/unspecified	3514 (17%)	66 (2%)	3580 (15%)
traumatic brain injury (any priority diagnosis)	3721 (18%)	652 (24%)	4373 (19%)

*Statistics are annual averages over the 2007-2011 period.

EMS responded to 50,836 nonfatal injuries from assaults among Hawaii residents over the 2007 to 2011 period. (Excluding records for patients with unknown resident status, those who were transferred to other EMS units (to avoid double-counting of injuries), and 177 patients who were described as dead on arrival.) These injuries resulted from 50,391 separate incidents, as almost all (99%) involved a single victim.

The incidents were broadly distributed in terms of time of day, although most (77%) occurred during the day time period of 6:31 a.m. to 7:29 p.m. (Figure 112). That proportion was greater for senior-aged patients (78%), including a peak from 7:31 a.m. to 12:29 p.m. (38%). There was less of a peak among patients under 65 years of age. There was little variation in the day of the week for falls, with as each day accounted for between 13% and 15% of the total.

More than half (57%) of the falls occurred in the home or residence of the patient, and this proportion was significantly higher among the seniors (71%) compared to younger aged patients (41%). Other indoor location or buildings accounted for 16% of the falls, followed by streets and roadways (5%), and health care facilities (4%). Only about 4% occurred in outdoor or recreation areas. (These statistics include 13% of patients who fell in “other” locations.) Female patients (52%) slightly outnumbered males (48%), although they constituted a greater majority (60%) among the seniors. More than half (54%) of the patients were 65 years or older, including 22% who were 85 years or older.

Injuries from falls were generally more severe than other types of injuries treated by EMS, as only 15% of the patients were not transported to hospitals (Figure 113). Nearly half (46%) were transported in “serious” or “critical” condition. Senior-aged patients had worse dispositions, as they were more likely to be transported in serious condition and less likely to be released at the scene. The proportion of patients who were transported in critical condition was comparable between the two age groups, however. Patient condition was not associated with the time of day of the fall or the day of week.

Figure 112. Time distribution of EMS-attended nonfatal injuries from falls, by patient age, 2007-2011.

(Horizontal scale indicates time of EMS dispatch, rounded up to nearest hour (military time scale, starting at 6:00am). Vertical scale indicates percent of all incidents, rounded to nearest whole number.)

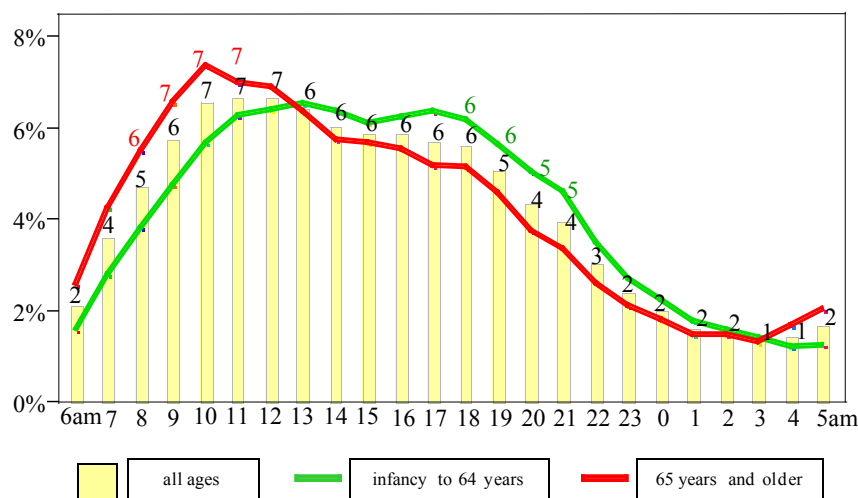
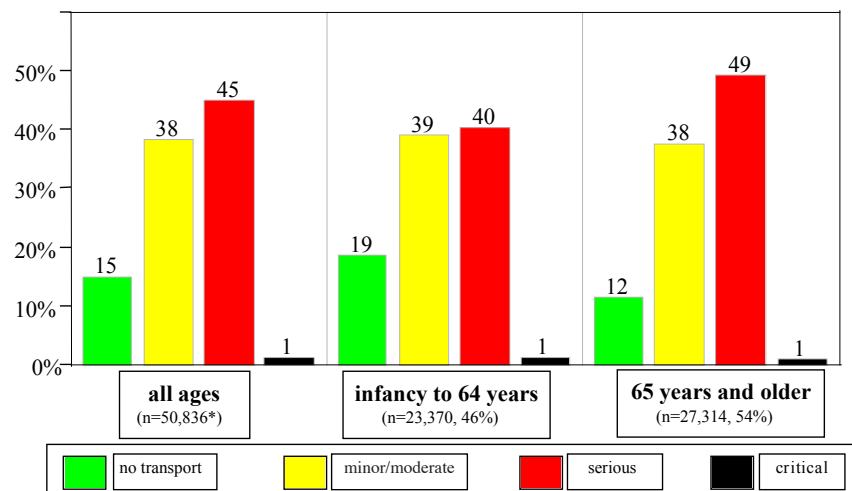


Figure 113. Distribution of injury severity/transport status of residents treated by EMS personnel for nonfatal injuries from falls, by age group, 2007-2011.



*Includes 152 patients for whom age was not recorded.

Probable alcohol use was noted 8% (29%, or 3901) of the patients (Table 25). Patients who had used alcohol were significantly younger than other patients, and nearly 3 times less likely to be in the senior age range. Male patients were more than twice as likely to have used alcohol compared to females (12% vs. 5%), and this difference was consistent across both age groups. There were no differences in the proportion of patients who were released at the scene, but drinkers were significantly more likely to be transported in “serious” condition. Patients who used alcohol were more likely to have fallen on weekends and nearly 3 times more likely to have fallen during night time hours.

Table 25. Characteristics of patients with EMS-treated nonfatal injuries from falls, by category of alcohol use, 2007-2011.

	Alcohol use (n=4,217, 8%)	No alcohol use (n=25,039, 49%)	No data/unknown (n=21,580, 42%)
Average age	51 years	62* years	63* years
Ages 65 years and older	20%	57%*	57%*
Gender (% male)	72%	45%*	46%*
Disposition			
no transport	15%	15%	15%
minor/moderate injuries	34%	40%*	37%*
serious injuries	50%	43%*	46%*
critical injuries	1.0%	0.9%	1.8%*
Weekend fall (Sat/Sunday)	37%	27%*	28%*
Nighttime fall (8 pm - 5 am)	52%	19%*	22%*

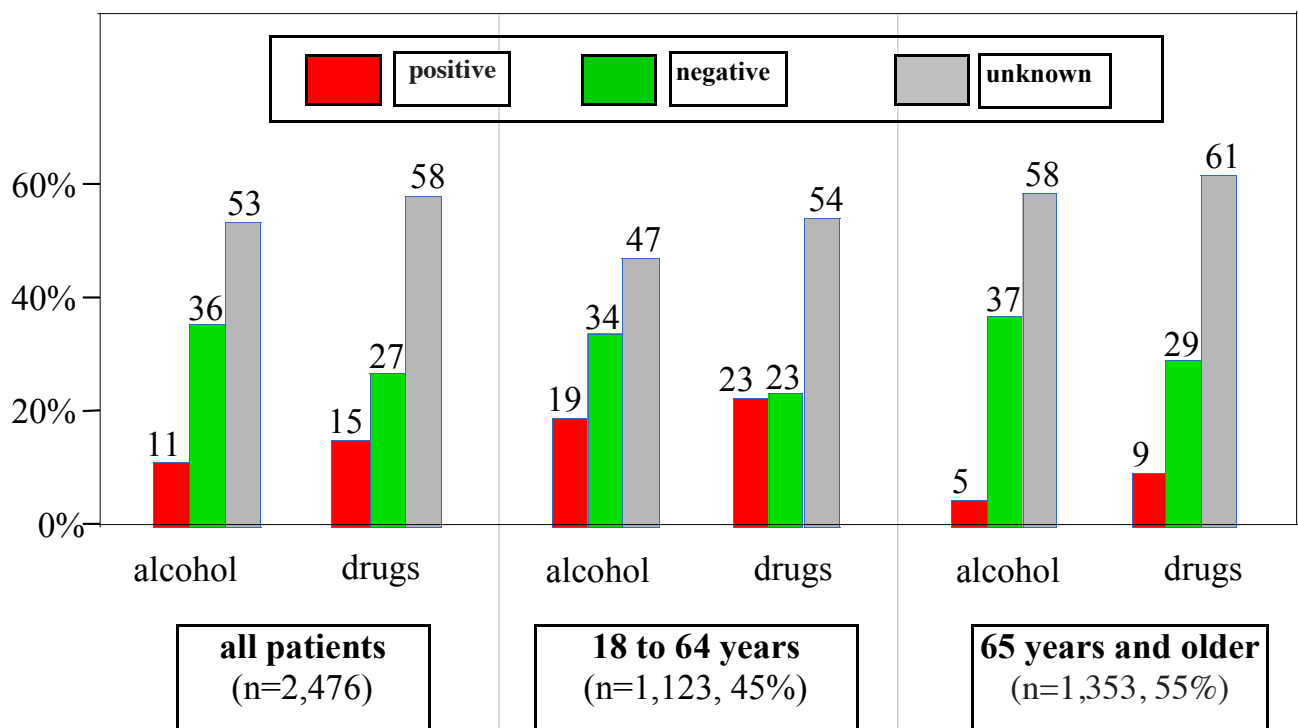
*Indicates statistically significant difference between patients who used alcohol vs. other patients.

Trauma Registry data

Only 11% of the adult-aged (18 years and older) HTR resident patients who were injured by falls were positive for alcohol use at the time of their injury, although more than half (53%) were not tested (Figure 114). Alcohol use was nearly 4 times higher among patients in the 18 to 64 year age group (19%), compared to senior-aged patients (5%). Fifteen percent of the patients tested positive for illicit drugs, most commonly narcotics (11%). Almost all (97%, or 120) of the 124 senior-aged patients who were positive for drugs were positive for narcotics. Considered together, about one-quarter (24%, or 587) of the patients tested positive for either alcohol or drugs, although that proportion was much lower among the senior-aged patients (13%), compared to younger patients (36%).

Alcohol use was significantly more likely among the male patients (9%) compared to females (3%), among those injured on weekends (16% vs. 9% for those hit on weekdays), and more than 4 times as likely among patient injured hit during night time hours (28%) than among those injured between 6:30 a.m. and 7:29 p.m. (6%). Alcohol use was not significantly associated with the mortality rate or likelihood of a discharge to a rehabilitation facility among the senior-aged patients. Among younger patients, however, the mortality rate among the drinkers was significantly higher (7.0%, or 15 of 215), compared to those who tested negative (3.4%, or 13 of 380).

Figure 114. Alcohol and/or drug use (percent) among residents treated for falls in the Hawaii Trauma Registry, by age group, 2008-2011.



The remainder of this chapter will describe nonfatal injuries from falls among senior-aged residents. As per residents of all ages, there was a generally increasing trend in the annual number of falls among seniors, and this was most evident for falls treated in EDs as there was an increase of 13% over the 5-year period (Table 26). Females comprised two-thirds of the patients treated in EDs and 69% of those who required hospitalization. More than one-third (39%) of the patients were 85 years or older, and this proportion was higher among patients who were hospitalized (46%). The annual number of falls increased consistently across the age groups listed in Table 17. Most (72%) of the patients were residents of Honolulu County, and residents of Hawaii County comprised about half of the remainder (14% overall). The number of Maui County residents who were hospitalized was approximately double the number from Kauai County (193 vs. 91 patients).

Table 26. Demographic characteristics* of senior-aged Hawaii residents with nonfatal injuries from falls.

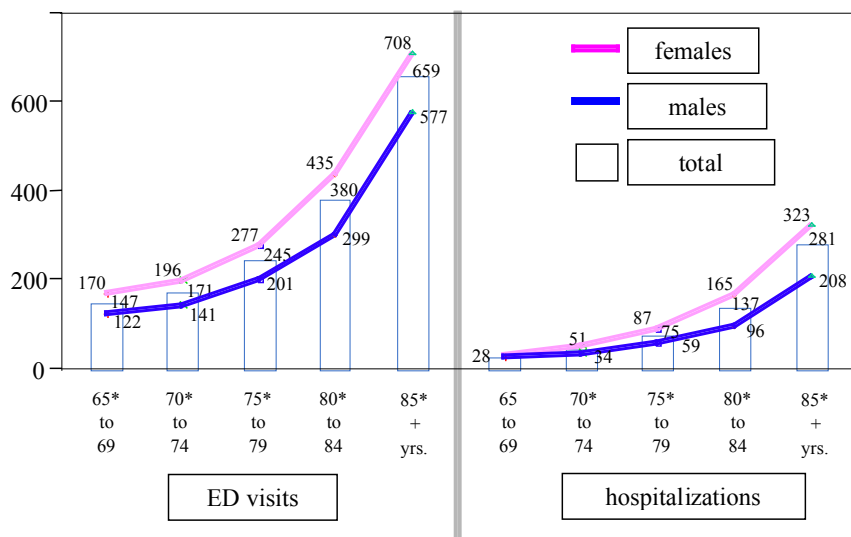
	ED visits	ED visits	ED visits
Year of admission			
2007	5043	1751	6794
2008	5200	1842	7042
2009	5604	1856	7460
2010	5590	1860	7450
2011	5719	1868	7587
average annual total	5431	1835	7267
Patient gender			
Female	3561 (66%)	1269 (69%)	4830 (66%)
Male	1870 (34%)	566 (31%)	2436 (34%)
Patient age			
65-69y	750 (14%)	142 (8%)	892 (12%)
70-74y	681 (13%)	171 (9%)	852 (12%)
75-79y	875 (16%)	268 (15%)	1142 (16%)
80-84y	1159 (21%)	418 (23%)	1577 (22%)
85+y	1966 (36%)	837 (46%)	2803 (39%)
County of residence of patient			
Hawaii	767 (14%)	227 (12%)	994 (14%)
Honolulu	3878 (71%)	1324 (72%)	5202 (72%)
Kauai	380 (7%)	91 (5%)	472 (6%)
Maui	406 (7%)	193 (11%)	599 (8%)

*Statistics are annual averages over the 2007-2011 period.

The increasing number of injuries from falls across the senior age range translated into extremely high rates for the oldest residents, for both injuries treated at EDs and those that required hospitalization (Figure 115). Rates of ED visits among residents aged 85 years and older were 4 times higher than rates among 65 to 69 year-olds, while hospitalization rates were 10 times higher for the oldest group compared to the youngest. Female residents had significantly higher rates of both kinds of injuries at every age group listed, with the exception of hospitalizations among 65 to 69 year-olds. Age-standardized rates for ED visits were 35% higher among females than males (303 patients/10,000 residents vs. 224/10,000), while hospitalization rates were 52% higher among females (102/10,000 vs. 67/10,000), and these differences were generally consistent over the age groups shown in Figure 88. Similar relationships between age and gender and nonfatal injury rates were seen within each of the 4 counties.

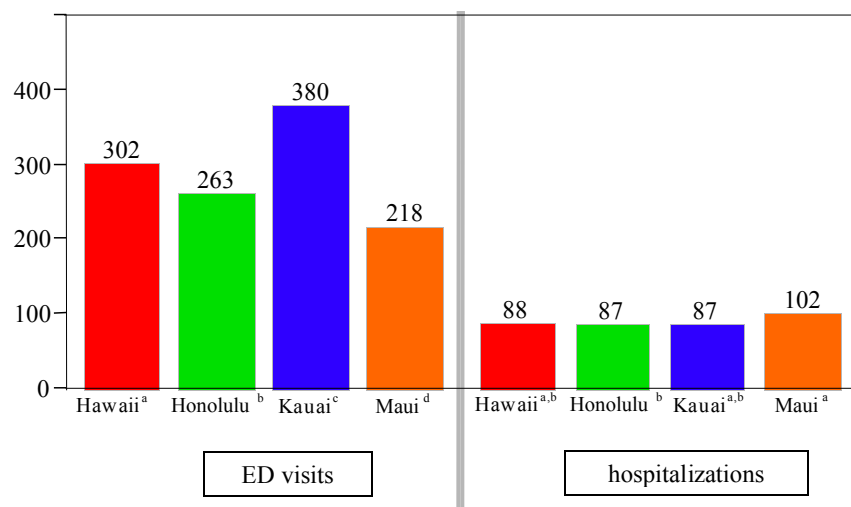
The comparison of county-specific rate estimates for senior residents (Figure 89) was similar to that for residents of all ages (see Figure 116): the highest rates for ED visits were computed for residents of Hawaii and Kauai counties, significantly higher than the other two counties. While rates for ED visits for Maui County residents were significantly lower than for any other county, Maui residents had the highest rate for hospitalizations, significantly higher than the rate for senior-aged residents of Honolulu County. These patterns were similar when county-specific rates were computed separately for each gender.

Figure 115. Rates (per 10,000 residents) of nonfatal injuries from falls among senior residents of Hawaii, by gender and level of care, 2007-2011.



*Indicates statistically significant difference in rate between males and females of that age group.

Figure 116. Age adjusted* annual rates (per 10,000 residents) of nonfatal injuries from falls among seniors, by level of care and county of residence of patient, 2007-2011.



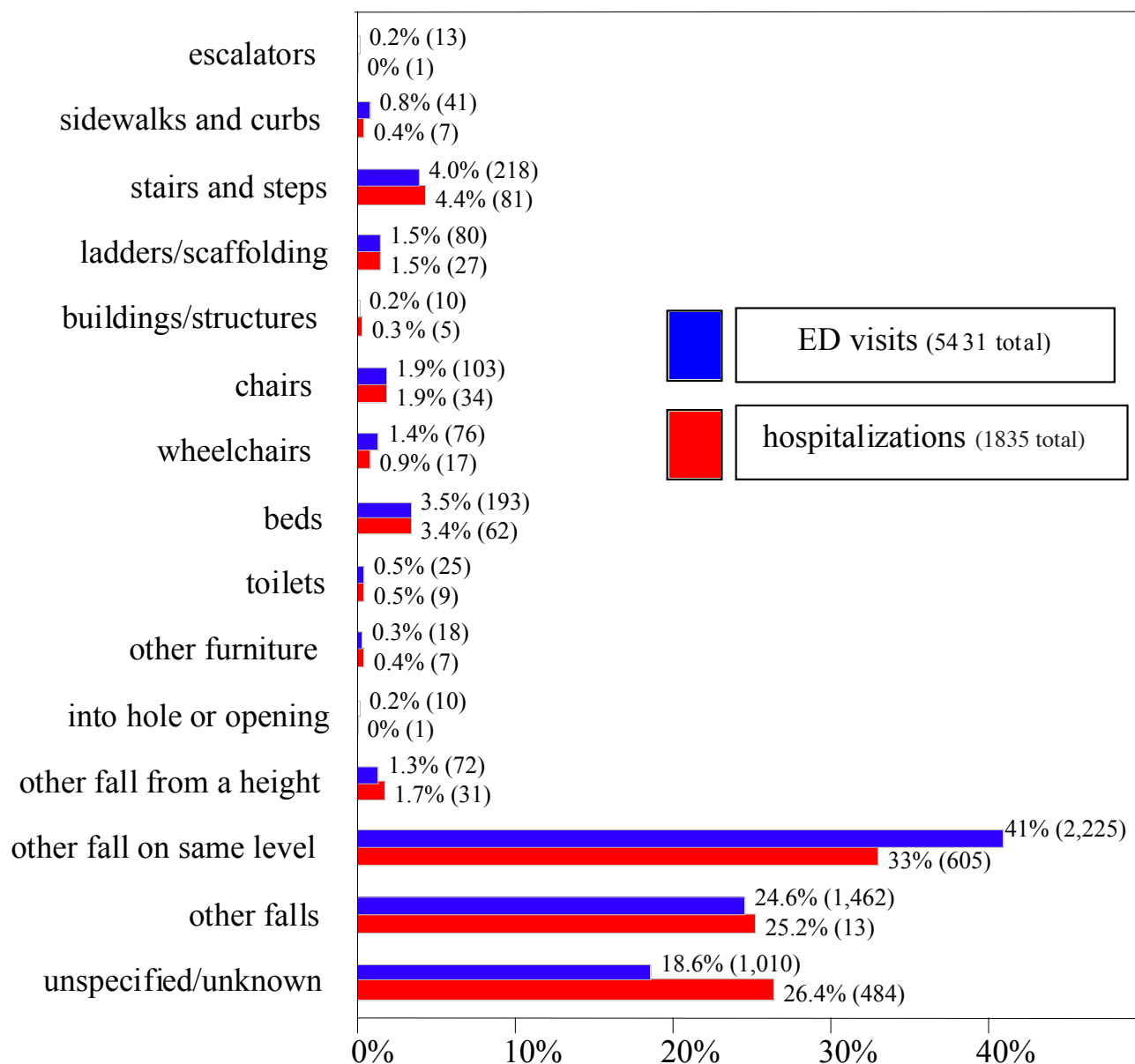
(Counties with the same superscripted letter have statistically comparable rate estimates.)

*Adjusted using the 5 age groups shown in figure 88, above.

There was little information on the cause of falls among seniors, as most of the injuries treated in EDs (84%) and requiring hospitalization (84%) were coded as “falls on same level” or due to “other” and “unspecified” causes (Figure 117). This lack of specificity may reflect either poor documentation in the medical records, or simply less involvement of the external environment as a cause of falls among seniors. The proportion of records with these vague causes increased progressively across the age range of patients, from 78% among 65 to 69 year-old patients to 86% among those 85 years and older. The distribution of the other, more specific, causes was similar between ED visits and hospitalizations, with stairs and steps and beds being the most commonly mentioned causes (about 4%).

There was no information on the location of the injury for over half (53%) of the ED records and 37% of the hospitalization records. The most specifically coded injury location was the home, for both ED (34%) and hospitalization records (53%). The proportion of falls in the home increased across the age range from 32% for patients aged 65 to 69 years to 43% for those 85 years and older.

Figure 117. Causes of nonfatal falls among senior-aged Hawaii residents, by level of care, 2007-2011.



Because hospitalizations among seniors injured by falls were long (one week on average), the total number of patient days for hospitalizations was more than twice the number patient days in EDs (Table 27). Among the patients hospitalized, 37% stayed for 1 week or longer, and 9% for 2 weeks or more. These long stays also resulted in a high average charge per hospitalization (over \$32,000), with total annual charges being nearly 6 times higher than the charges for ED visits (\$70.1 vs. \$12.2 million).

The distribution of injuries among hospitalized seniors was similar to that for patients of all ages (see Table 16): three-fourths (75%) had fractures, and 20% had internal injuries. Proportionally more of the fractures among seniors were femur fractures, however (41% vs. 32% for patients of all ages). Almost all (93%) of the femur fractures among hospitalized seniors were fractures of the neck of the femur, or hip fractures. About one-third (30%) of the injuries treated in EDs were contusions or superficial injuries, 22% were open wounds, and 23% were fractures, most commonly fractures of the lower arm or hand (6%). About one-fourth (23%) of the patients had TBI, and this proportion was similar across patients treated in EDs (22%) and those who were hospitalized (23%). (TBI counts included diagnoses of any priority.)

Table 27. Clinical characteristics* of Hawaii senior residents with nonfatal injuries from falls.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	7.0	2.5
Total number of days	5,431	12,913	18,345
Average charge	\$2,239	\$31,725	\$9,652
Total charges	\$12.2 million	\$58.2 million	\$70.1 million
Primary injury diagnosis			
fractures	1227 (23%)	1371 (75%)	2598 (36%)
fracture of skull	86 (2%)	56 (3%)	142 (2%)
vertebral column	153 (3%)	197 (11%)	350 (5%)
ribs, pelvis or trunk	253 (5%)	173 (9%)	425 (6%)
humerus	193 (4%)	67 (4%)	259 (4%)
lower arm or hand	339 (6%)	40 (2%)	379 (5%)
femur	32 (1%)	756 (41%)	788 (11%)
lower leg or foot	172 (3%)	81 (4%)	253 (3%)
other/unspec. fractures	1 (0%)	0 (0%)	1 (0%)
sprains and strains	356 (7%)	15 (1%)	371 (5%)
internal injuries	168 (3%)	363 (20%)	531 (7%)
open wounds	1194 (22%)	19 (1%)	1214 (17%)
contusion/superficial	1617 (30%)	36 (2%)	1653 (23%)
other/unspecified	869 (16%)	31 (2%)	900 (12%)
traumatic brain injury (any priority diagnosis)	1216 (22%)	425 (23%)	1641 (23%)

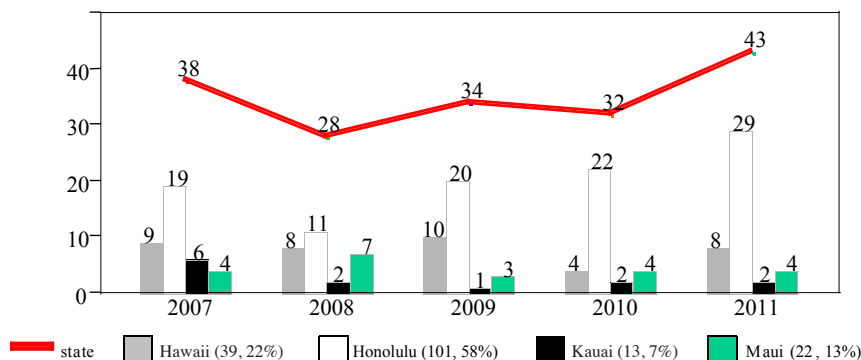
*Statistics are annual averages over the 2007-2011 period.

Drownings and Near Drownings

Fatal injuries

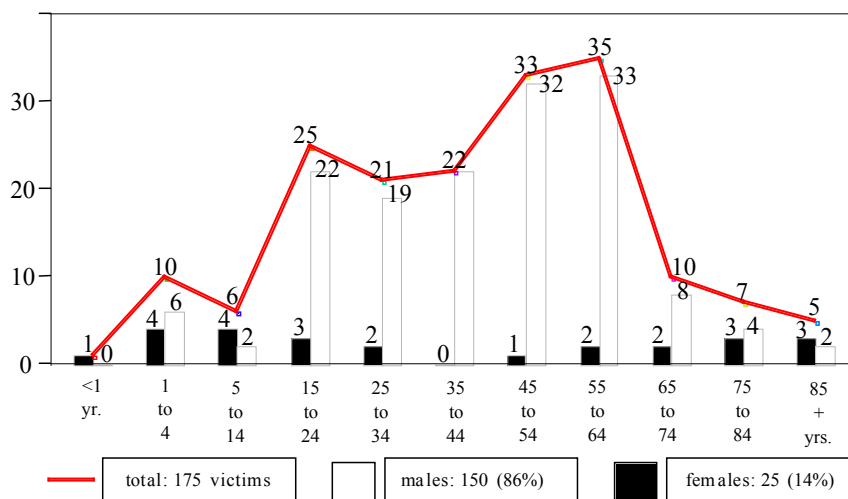
Drownings were the 4th leading cause of unintentional injury fatalities, with 175 fatalities over the 5-year period. There were anywhere from 28 to 43 drownings per year among state residents, with the highest total occurring in 2007 (Figure 118). More than half of the drownings (58%, or 101) occurred on the island of Oahu, 39 (22%) on Hawaii, 22 (13%) in Maui County (18 on the island of Maui, 2 on Molokai, and 2 on Lanai), and 13 (7%) on Kauai. There was an increasing trend in the annual number of drownings on Oahu from 2008 to 2011 (from 11 to 29), but no apparent trends for the other counties.

Figure 118. Annual number of drownings among Hawaii residents, by county, 2007-2011.



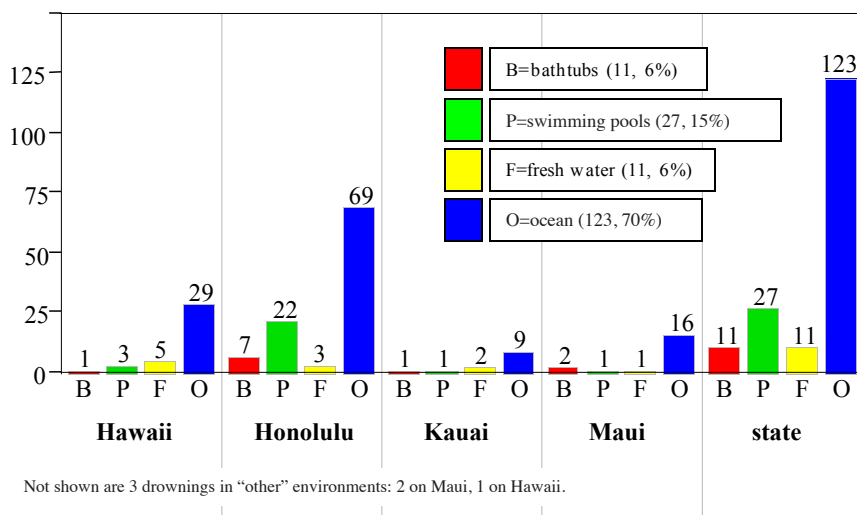
Drownings occurred at every age but were least common among children and residents aged 65 years or older (Figure 119). Seventy-eight percent (136) of the victims were between the ages of 15 and 64 years. The figure also shows that most (86%, or 150) of the victims were males. The proportion of female victims was greatest in the youngest and oldest age ranges.

Figure 119. Age and gender distribution of resident drowning victims in Hawaii, 2007-2011.



Most (70%, or 123) of the victims drowned in the ocean or other saltwater environments such as canals or harbors (Figure 120). Eleven others drowned in bodies of freshwater (streams, ponds, waterfalls), 27 in swimming pools, 11 in bathtubs, and 3 in other types of environments (e.g. drainage canal). Most (81%, or 22) of the drownings in pool occurred on Oahu. Most of the 11 bathtub drowning victims were either under 4 years of age (4 victims), or 68 years or older (4). In contrast, only 3 (2%) of the 123 victims who drowned in the ocean were under 5 years of age, and only 9 (7%) were under age 18. Residents in the 50 to 64 year age range comprised 39% (48) of the victims, and had the highest rates of ocean drownings. Most (92%) were males.

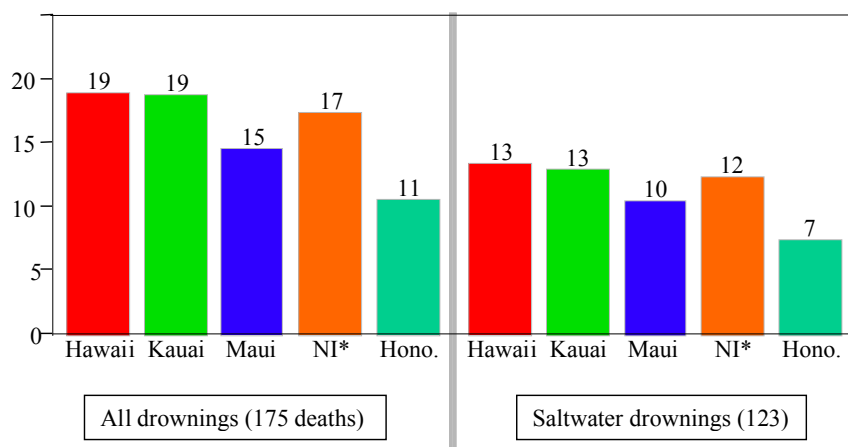
Figure 120. Drownings of Hawaii residents, by environment and county, 2007-2011.



Although the majority of the drownings occurred in Honolulu County, Figure 121 shows that the rates of both all types of drownings and saltwater drownings were lowest among residents of that county. For either outcome, the rates for Honolulu County residents were significantly lower than for residents of Hawaii County or Neighbor Island residents as a whole. Among the Neighbor Islands, residents of Maui County had the lowest rates of both types of drownings, although the rates for all Neighbor Islands were statistically comparable. Note that the saltwater drowning rates for Hawaii and Kauai counties were basically the same, but only the former was statistically different from the rate for residents of Honolulu County. This was probably due to the low number of such drownings on Kauai County, which resulted in a relatively imprecise rate estimate and less power to detect a "significant" difference between the 2 counties.

Figure 121. Rate of all types of drownings (left side) and saltwater drownings (right side) among Hawaii residents, by county of injury, 2007-2011.

(Rate is per 100,000 residents, age-standardized to the 2000 U.S. population distribution.)



*NI=Neighbor Island residents (combined total of Hawaii, Kauai, and Maui counties.)

Figures 122 and 123 also show the approximate location of the drownings on Oahu and the Neighbor Islands, respectively. (Four incidents were excluded since their approximate locations could not be determined.) One-third (33%, or 9) of the 27 drownings in swimming pools were at a single family residence, about half (48%, or 13) were in condominiums or apartment buildings, 3 in community centers, and the remaining 2 in hotel pools. The 22 drownings on Oahu were widely dispersed around the southern and central parts of the island. Similarly, the freshwater drownings were widely dispersed geographically, with at least 1 on each of the 4 main islands. All 4 drownings in Hawaii County were north of Hilo, including 2 in the Wailuku River in Hilo.

About half (52%, or 36) of the 69 ocean drownings on Oahu were on the eastern part of the island, including 3 near Ala Moana Beach Park, 3 along Waikiki Beach, 5 on the stretch from Kapiolani Park to Diamond Head, 4 off Portlock, and 5 near in Makapuu Bay. There were also 8 drownings along the Waianae coast, and 7 on the North Shore, from Mokuleia to Turtle Bay.

Five of the 29 ocean drownings on the island of Hawaii were on the Kona coast (from Kailua south to Kealahou Bay), 8 in the Puna district, and 6 on the southern tip of the island from Punaluu to Manuka Bay. Most (7) of the 9 ocean drownings on Kauai were on the north and northeast coasts. Drownings were widely dispersed in and Maui County, although there were none in the Hana district.

Figure 122. Approximate locations of drownings on Oahu among Hawaii residents, by environment, 2007-2011.

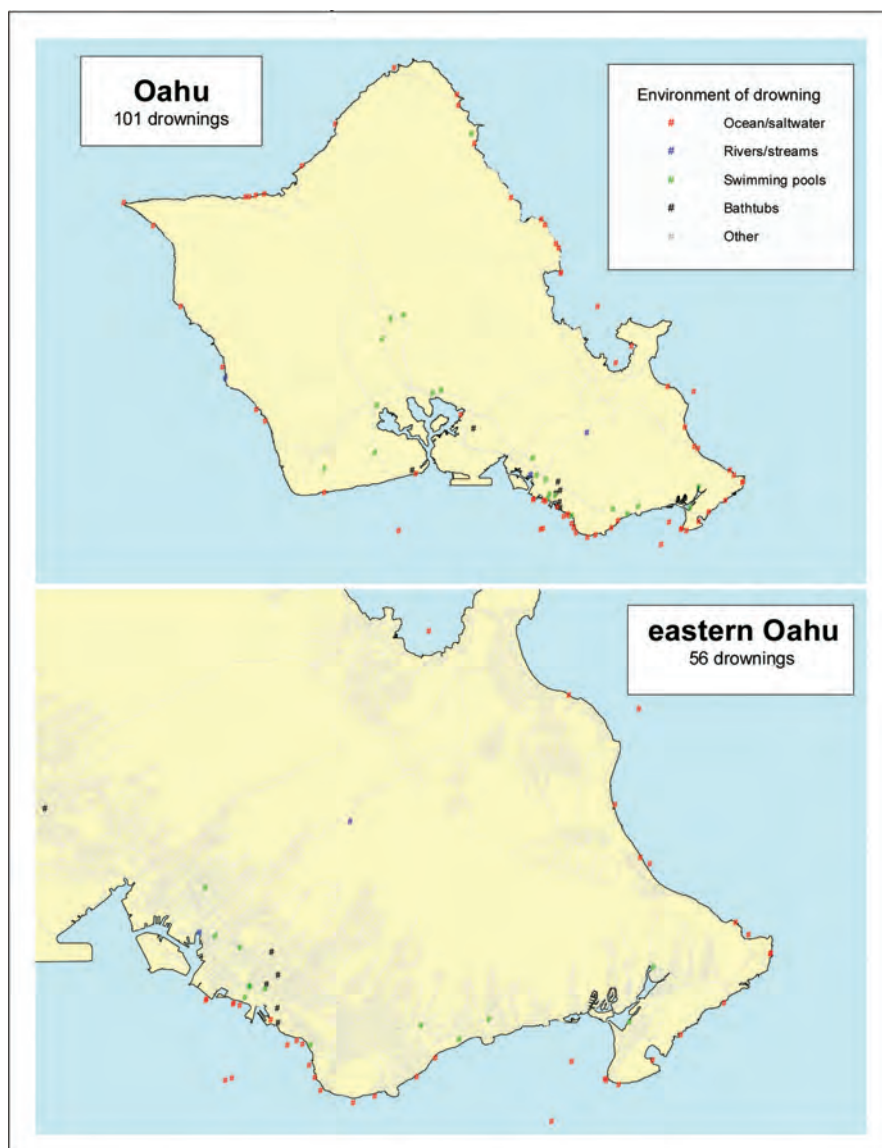
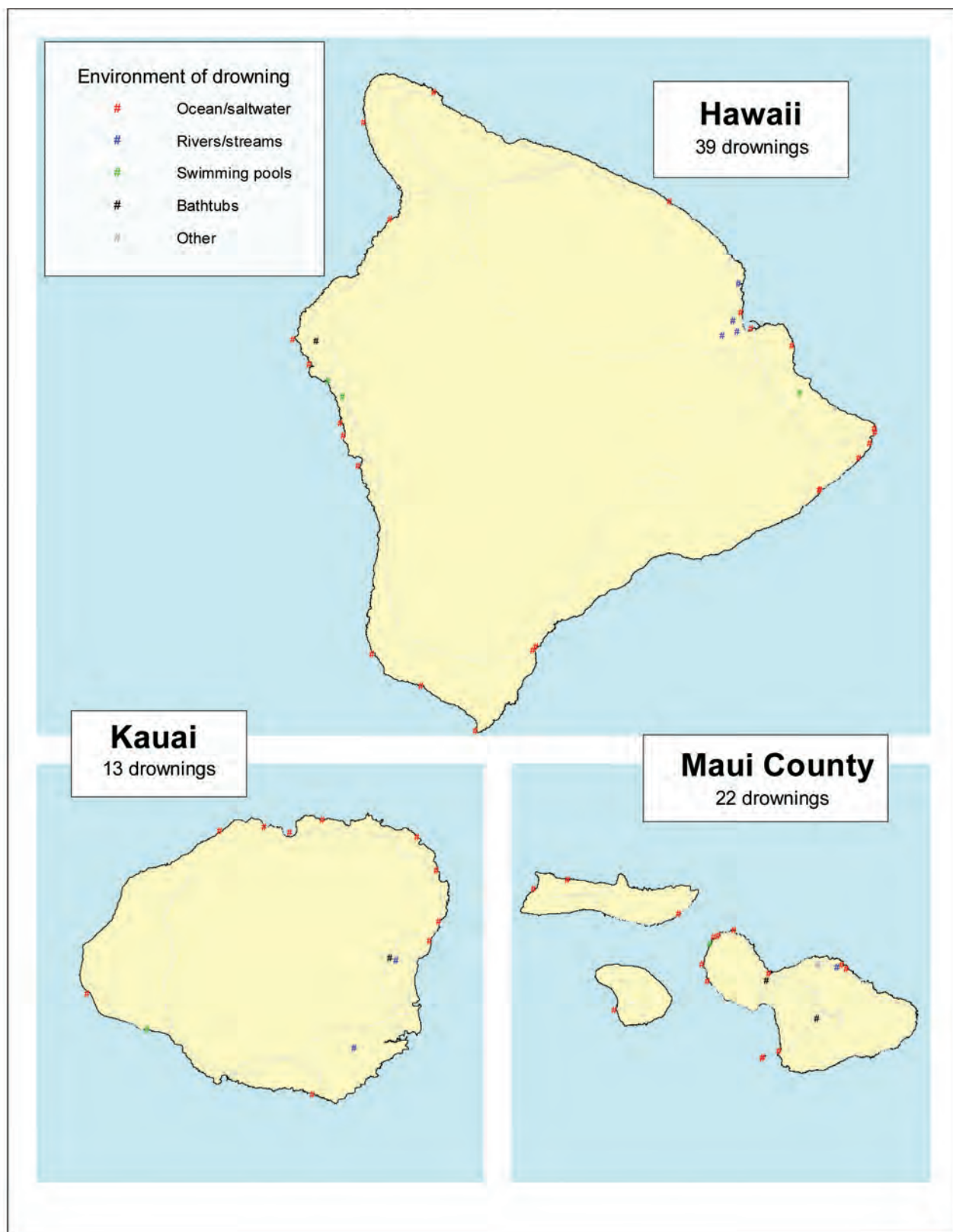
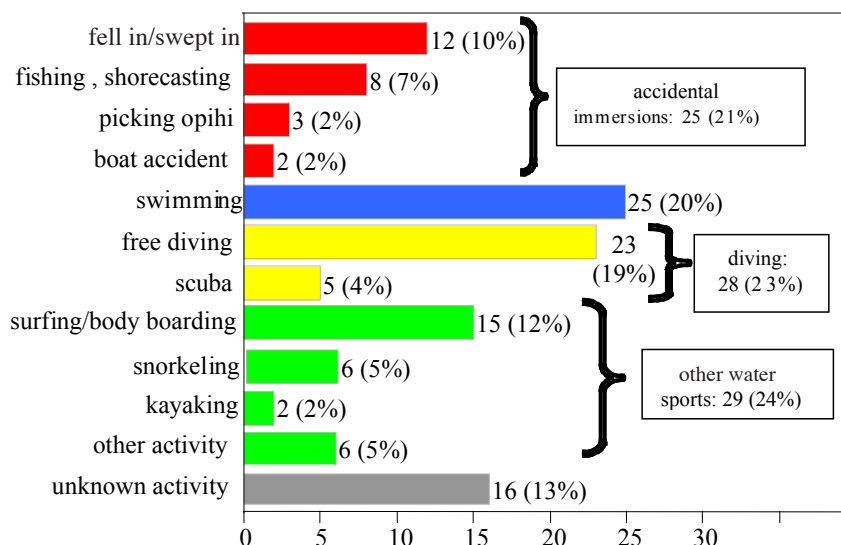


Figure 123. Approximate locations of drownings on Neighbor Islands among Hawaii residents, by environment, 2007-2011.



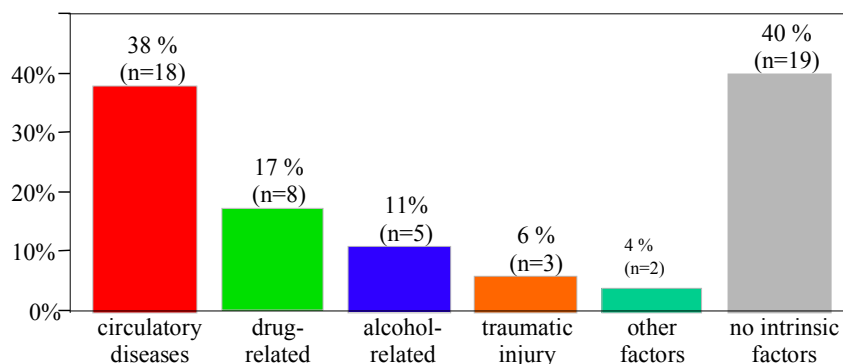
Unintentional immersions were responsible for about one-fifth of the 123 drownings in the ocean or other saltwater environments (Figure 124). Twelve of these 25 victims fell in or were swept in from shore while not engaged in any specific activity, 8 were fishing from shore, 3 were picking opihi, and another 2 drowned after boat accidents. All 3 opihi pickers drowned on the island of Hawaii. Swimming was the single most common activity among the victims (25 drownings). Twenty-eight of the drownings were diving-related, and most of those (82%, or 23) were among “free” divers (i.e. those not using scuba equipment).

Figure 124. Saltwater drownings among Hawaii residents, by activity of victim, 2007-2011.



Autopsy records were reviewed for all but 1 of the 48 ocean drownings in Honolulu County over the 2007 to 2010 period. A number of personal factors were identified from autopsy records which at least partially contributed to the 48 saltwater drownings. These are factors which had nothing to do with the environment in which the person drowned, and are therefore referred to as intrinsic factors: circulatory diseases, alcohol and drug use, seizure disorders, and traumatic injuries.

Figure 125. Prevalence of intrinsic factors in Oahu saltwater drownings of Hawaii residents, 2007-2010.



*Percents do not add to 100 because some victims had more than 1 intrinsic factor.

Intrinsic factors were involved in 60% (28) of the 47 saltwater drownings over this period (Figure 125). The most common intrinsic factor was circulatory diseases, which contributed to 38% of the drownings. Most of these victims were noted to have ischemic heart disease or atherosclerosis. Circulatory diseases were noted as possible cause in over half (60%, or 18) of the 30 drownings among victims aged 35 years or older, and in all 6 drownings among senior-aged victims. Toxicology results were available for 45 of the victims. Eight (17%) of the victims tested positive for illicit drugs, including THC (3 victims), methamphetamine (3), cocaine (1), and MDMA (1). In comparison, only 5 (11%) had BAC levels of 0.08% or higher. Overall, about one-fifth of the victims (21%, or 10) had been drinking or tested positive for illicit drugs. That proportion was highest (50%, or 8) among the 16 victims in the 25 to 54 year age group. Three of the sustained traumatic injuries which led to their drownings.

Nonfatal injuries

There was non clear trend in the annual number of near drownings, which averaged 129 per year, most of which (77%) were treated in EDs (Table 28). Male patients (76% of the total) outnumbered females by about three-to-one for both ED visits and hospitalizations. Almost all the patients (89%) were under 55 years of age, and more than one-quarter (26%) were 15 to 24 years of age. Nearly one-third (31%) of the hospitalized patients were under 5 years of age, compared to 14% of those who were treated in EDs. About two-thirds (68%) of the patients were residents on Honolulu County.

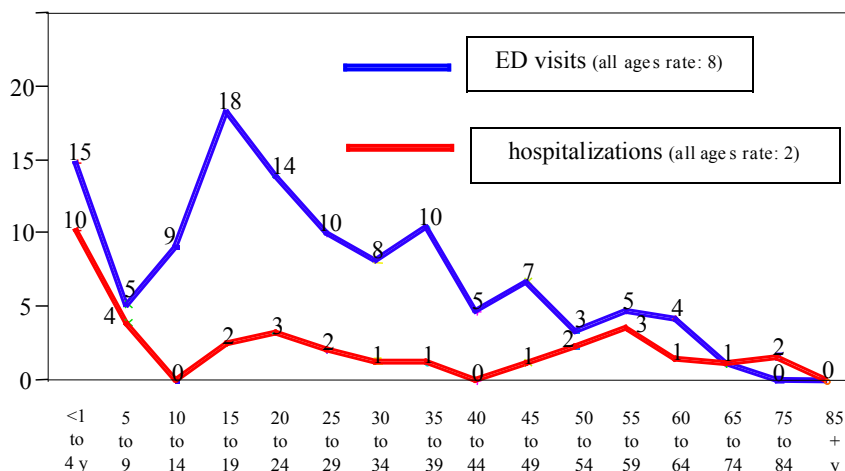
Table 28. Demographic characteristics* of Hawaii residents with nonfatal injuries from near drownings.

	ED visits	hospitalizations	total
Year of admission			
2007	86	29	115
2008	129	22	151
2009	102	33	135
2010	92	28	120
2011	89	37	126
average annual total	100	30	129
Patient gender			
Female	25 (25%)	6 (21%)	32 (24%)
Male	74 (75%)	23 (79%)	98 (76%)
Patient age			
infants	1 (1%)	0 (1%)	1 (1%)
1-4 y	13 (13%)	9 (30%)	21 (17%)
5-14 y	11 (11%)	3 (11%)	14 (11%)
15-24 y	28 (29%)	5 (16%)	33 (26%)
25-34 y	17 (17%)	3 (9%)	20 (16%)
35-44 y	13 (13%)	2 (5%)	14 (11%)
45-54 y	8 (8%)	2 (8%)	11 (8%)
55-64 y	7 (7%)	4 (13%)	11 (9%)
65-74 y	1 (1%)	1 (3%)	2 (1%)
75-84 y	0 (0%)	1 (3%)	1 (1%)
85+ y	0 (0%)	0 (1%)	0 (0%)
County of residence of patient			
Hawaii	18 (18%)	5 (16%)	23 (18%)
Honolulu	69 (69%)	19 (65%)	88 (68%)
Kauai	9 (9%)	1 (4%)	10 (8%)
Maui	4 (4%)	4 (15%)	9 (7%)

*Statistics are annual averages over the 2007-2011 period.

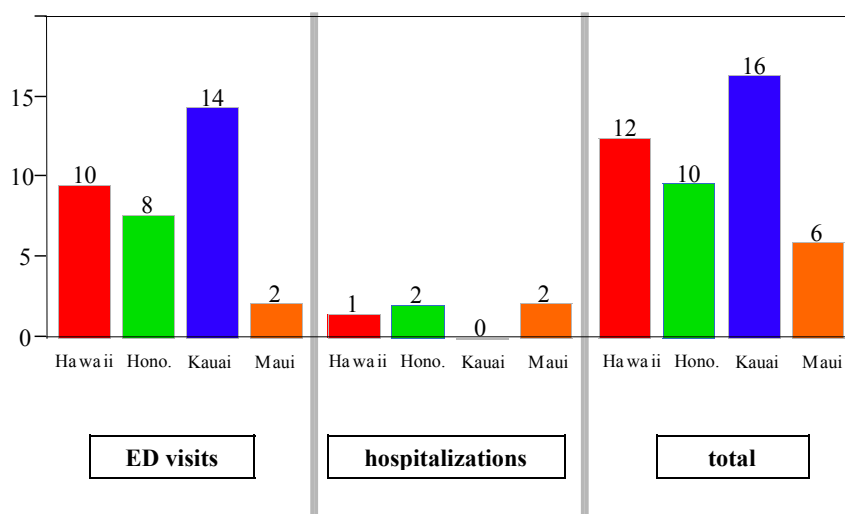
Residents under 5 years of age and those aged 15 to 24 years had the highest rates of ED visits, especially 15 to 19 year-olds (Figure 126). Rates of ED visits generally decreased among residents 20 years and older. The highest rates of hospitalization were computed for residents under 5 years of age, followed by those 5 to 9 years of age. Hospitalization rates varied little over the succeeding age groups.

Figure 126. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for near drownings in Hawaii, by age of patient, 2007-2011.



Residents of Maui County had significantly lower rates of ED visits, compared to residents of any other county. The rate for Maui County residents was at least 4 times lower than the rates for residents of any other county (Figure 127). The rates for the other 3 counties were statistically comparable. However, hospitalization rates were highest for residents of Maui and Honolulu counties.

Figure 127. Age adjusted annual rates (per 100,000 residents) of near drownings, by level of care and county of residence of patient, 2007-2011.



About two-thirds (68%) of the near-drownings were related to “recreational activity without diving equipment”. Two-percent involved use of diving equipment, and 3% were related to unintentional immersions from water transport accidents. Circumstances were “other” (20%) or “unknown” (4%) for the remaining near drownings. Nearly half (45%) of the near drownings occurred on a Saturday or Sunday. There were no apparent seasonal trends.

Hospitalizations were of a relatively short number of days (4.3, on average) (Table 29). Because each hospitalization incurred nearly \$32,000 in charges, however, they comprised most (91%) of the total medical charges in the state. Information on location of the near drowning was missing or unknown for about half (48%) of the patients. This proportion was lower (19%) among hospitalized patients, most of whom (58%) were in “other” environments, which could include beaches. “Other” areas comprised about one-quarter of the near drownings treated in EDs, followed by recreation areas (18%), which includes public pools. Only 4% occurred in home environments, which includes pools in private houses. Besides the ICD-9CM code for “drowning and nonfatal submersion”, patients were most commonly hospitalized for fractures (12%), and internal injuries (5%). Principal diagnoses for ED visits included submersion (28%), open wounds (26%), sprains and strains (12%), and contusions and superficial injuries (11%).

Table 29. Clinical characteristics* of Hawaii residents with nonfatal injuries from near drownings.

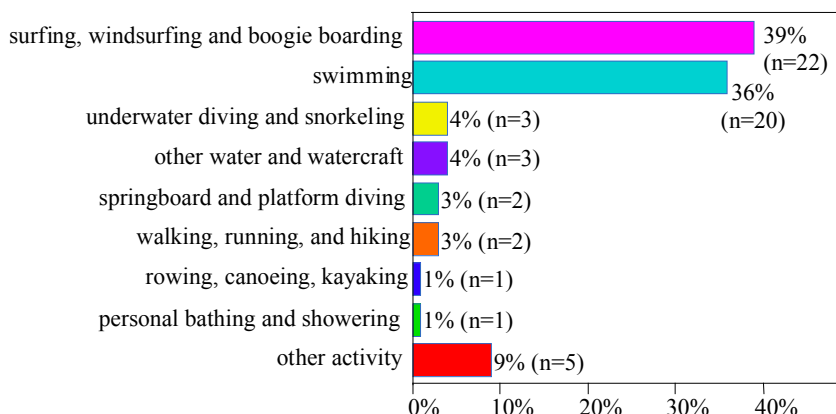
	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	4.3	1.8
Total number of days	100	129	229
Average charge	\$1,579	\$32,892	\$8,373
Total charges	\$0.2 million	\$1.0 million	\$1.1 million
Location			
recreation area, incl. public pools	18 (18%)	3 (11%)	22 (17%)
home, incl. swimming pools	2 (2%)	3 (10%)	5 (4%)
public building	1 (1%)	0 (1%)	1 (1%)
other places, incl. beach and sea	23 (23%)	17 (58%)	40 (31%)
other/unspecified	56 (56%)	6 (19%)	62 (48%)
Primary injury diagnosis			
drowning and submersion	28 (28%)	22 (75%)	50 (39%)
fractures	8 (8%)	4 (14%)	12 (9%)
sprains and strains	11 (11%)	0 (0%)	11 (9%)
internal injuries	2 (2%)	1 (4%)	4 (3%)
open wounds	25 (26%)	0 (0%)	25 (20%)
contusion/superficial	13 (13%)	0 (1%)	13 (10%)
other/unspecified	4 (4%)	12 (12%)	14 (11%)
traumatic brain injury (any priority diagnosis)	7 (7%)	2 (7%)	9 (7%)

*Statistics are annual averages over the 2007-2011 period.

Beginning in 2010, some hospitals started providing external cause status codes and activity codes. Information on patient activity was available for about 46% (112) of the 246 records from 2010 to 2011. Activity codes were more likely to be provided in ED records (50%) compared to inpatient records (34%). This proportion did not vary significantly across the county of the hospitals, but was higher in 2011 (56%) compared to 2010 (34%).

Most (75%) of the near drownings were related to “surfing, windsurfing and boogie boarding”, or swimming (Figure 128). The former category was more common among patients treated in EDs (46%, vs. 31% who were swimming), while 55% of the hospitalized patients nearly drowned while swimming. The distribution of patient activity also differed by county, as 46% of those treated in Oahu hospitals had been “surfing, windsurfing and boogie boarding”, compared to 17% to 25% of patients treated in other counties.

Figure 128. Activity of patients treated for near drownings in Hawaii, 2010-2011.



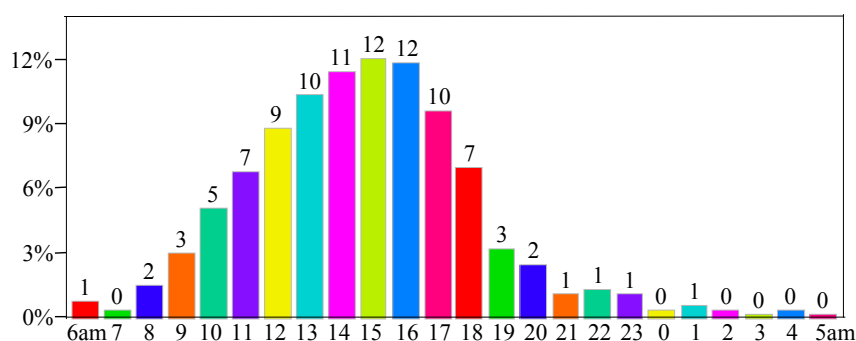
*Includes only hospital records with specific Activity codes, approximately 46% (112) of 246 total records for 2010 through 2011. Codes were more likely to be present in ED records (50%) compared to inpatient records (34%). Number in parentheses is annual average number of patients.

EMS responded to 544 near drownings among Hawaii resident over the 5-year period. (Excluding 12 records for patients who were transferred to other EMS units (to avoid double-counting of injuries), and 59 patients who were described as dead on arrival.) These were 530 separate incidents, as 97% involved a single near drowning.

Almost all (92%) of the incidents occurred during day time hours, with a broad peak between 11:31 a.m. and 5:29 p.m. (64%) (Figure 129). More than one-quarter (26%, or 136) of the incidents occurred on a Sunday, and 18% on a Saturday; the total varied between 9% and 14% for weekdays.

Figure 129. Time distribution of EMS-attended near drownings, 2007-2011.

(Horizontal scale indicates time of EMS dispatch, rounded up to nearest hour (military time scale, starting at 6:00am). Vertical scale indicates percent of all incidents, rounded to nearest whole number.)



More than one-third (38%) of the near drownings occurred in bodies of water, which could include both freshwater and saltwater environments. Another one-third (33%) were in patient residences (16%), public buildings (9%), hotels (4%), and health care facilities (3%). Most (65%, or 28) of the 43 night time incidents occurred in these types of environments. Another 17% were in “recreation areas”, which could presumably include both indoor and outdoor settings.

The incidents on Oahu were widely distributed, with the highest totals in Waikiki, North Shore, Hawaii Kai, and Waianae areas (Figure 130). The North Kona district had the highest total in Hawaii County, while the incidents in Maui and Kauai were more broadly distributed (Figure 131). There were also 8 incidents on the island of Molokai and 4 on Lanai (not shown on the Figure).

Figure 130. Number of EMS-attended drownings and near-drownings on Oahu and eastern Oahu (bottom map), by Neighborhood Board, 2007-2011.

(Percent of all EMS-attended drownings/near-drownings in the state is shown in parentheses.)

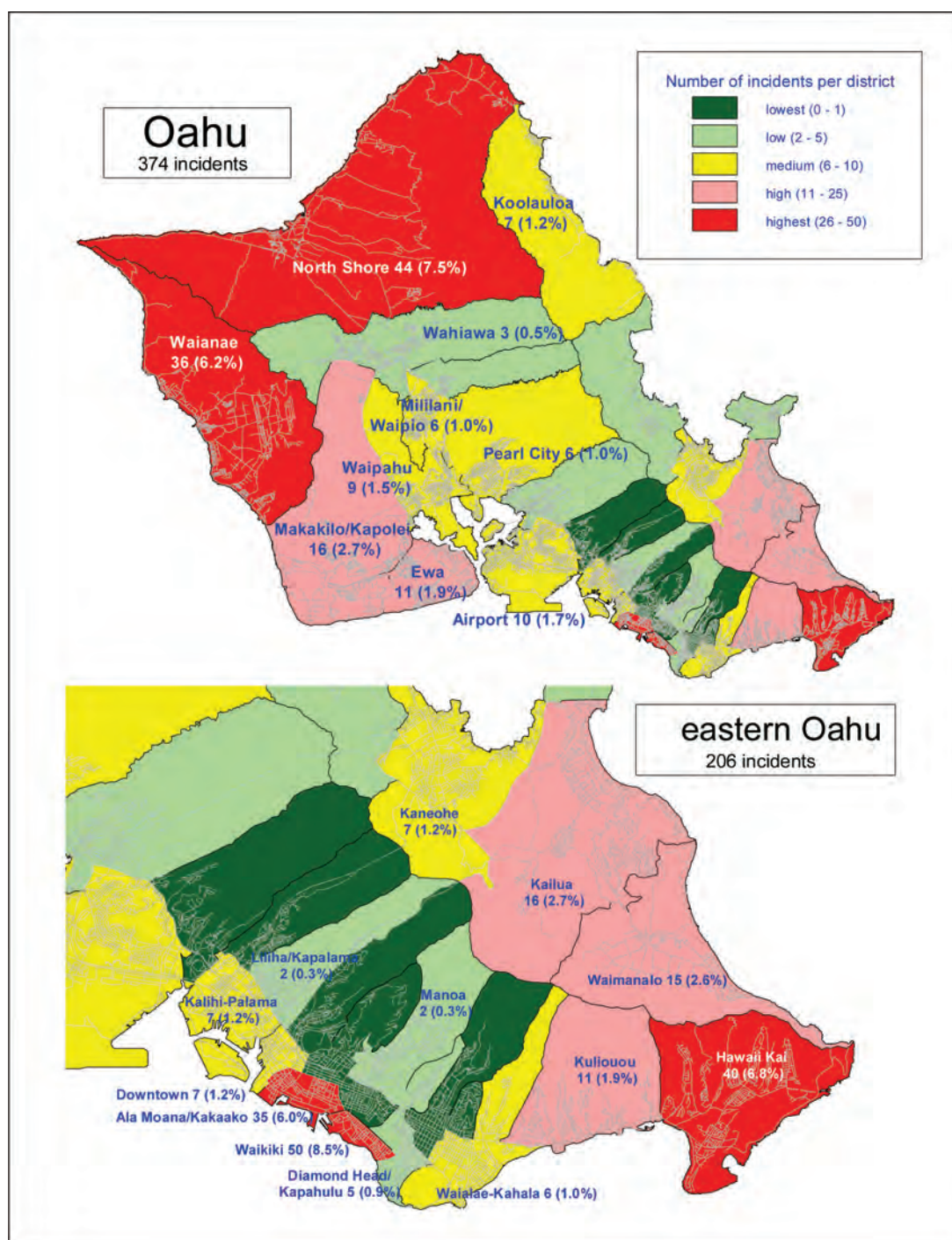
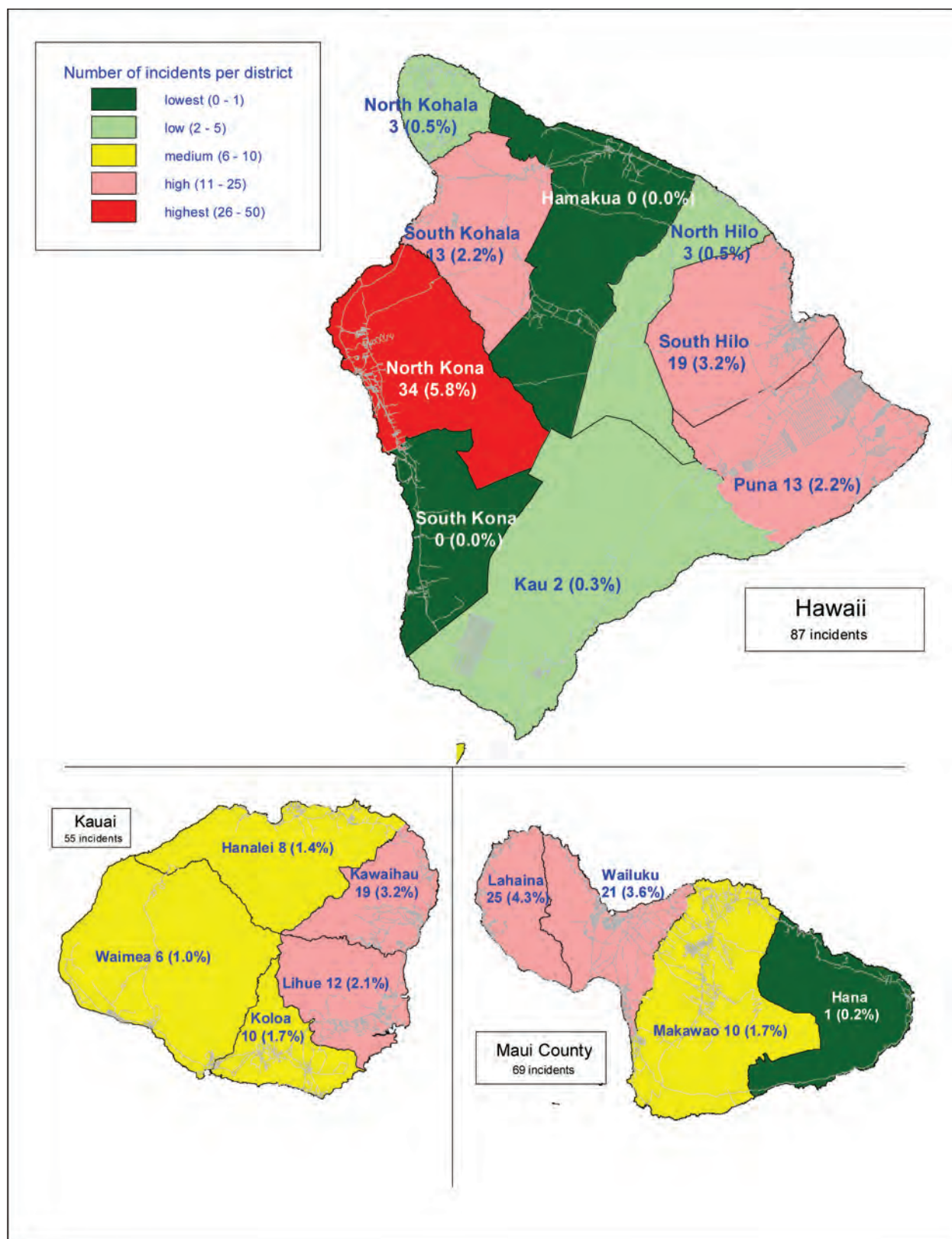


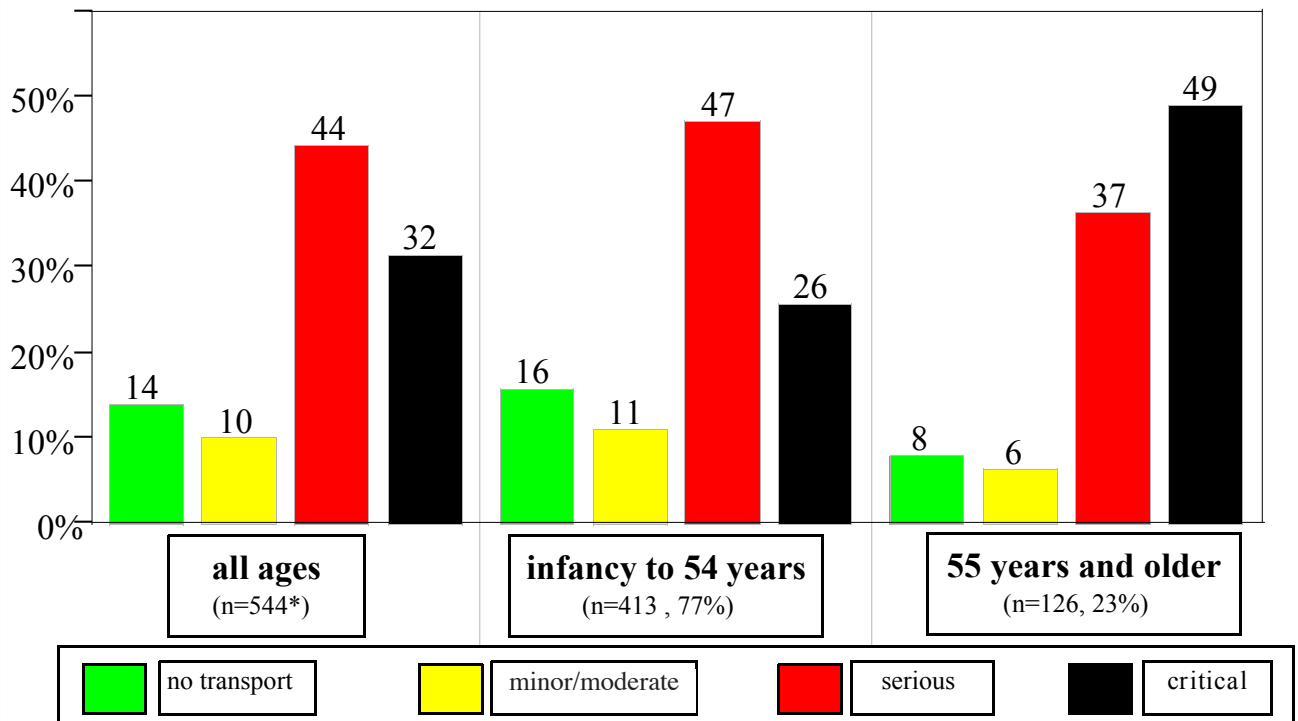
Figure 131. Number of EMS-attended drownings and near-drownings on Neighbor Islands, by district, 2007-2011.

(Percent of all EMS-attended drownings/near-drownings in the state is shown in parentheses.)



Most (76%) of the patients were either transported in “serious” (44%) or “critical” (32%) condition (Figure 132). Patient condition did not differ significantly by incident location, or the time of day of the near drowning or the day of week. However, figure 132 shows patients older than 54 years of age were significantly more likely to be transported in serious or critical condition and half as likely to have been released at the scene. Disposition was also generally better among female patients, including a significantly lower proportion who were transported in critical condition, compared to male patients (23% vs. 36%, respectively).

Figure 132. Distribution of injury severity/transport status of EMS-attended near drownings among Hawaii residents, by age group, 2007-2011.



*Includes 5 patients for whom age was not recorded.

Probable alcohol use was noted for only 4% (22) of the patients. This proportion did not vary significantly by patient gender, residence status, or by county or day of week of incident. There were also no significant associations between patient age or disposition and their use of alcohol, although these comparisons are limited by small numbers. Near drownings that occurred during night time hours were significantly more likely to involve alcohol consumption than day time incidents, however (23% vs. 2%).

Trauma Registry Data

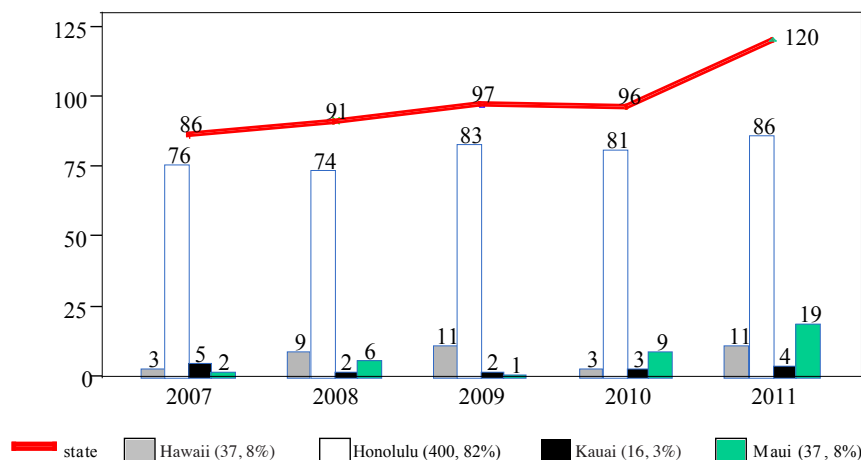
Information on the toxicological status of the 34 residents who were in the HTR for drownings or near-drownings is given on page 198. Among the 31 adult-aged patients, 13% were positive for alcohol and 13 were positive for illicit drugs.

Poisonings

Fatal injuries

Poisonings were the 2nd leading causes of unintentional injury fatalities in the state, with 490 over the 5-year period, or an average of 98 deaths each year (Figure 133). There was a generally increasing trend in the annual number of poisonings, with a particularly large increase in 2011. However, trends are difficult to examine because poisonings make up a large proportion of injury deaths where the intent could not be established (see Figure 170), or they can also be classified as suicides. There was no consistent trend in the annual number of poisonings of undetermined intent over this period, so the observed trend in unintentional poisonings was probably not due to disparities in coding. It is also difficult to know the accuracy with which the intent was determined over the years and across the 4 different counties. Most (82%) of the poisonings that were coded as unintentional occurred on Oahu. However, if poisonings of undetermined intent are also included, that proportion drops to 63% because proportionally more of the poisonings on Neighbor Islands were coded as undetermined intent. Most of the poisonings on Hawaii (67%, or 75 of 112) and Maui counties (69%, or 83 of 120) were coded as undetermined intent, compared to only 12% (53 of 453) of those on Oahu.

Figure 133. Annual number of fatal poisonings among Hawaii residents, by county, 2007-2011.



Compared to most injury categories, the age distribution of poisoning victim was narrowly distributed, with a peak among 35 to 64 year-old victims (Figure 134). Most (81%, or 396) of the victims were in this 30-year age group, including 39% (193) who were 45 to 54 years of age. Only 4 of the victims were under 18 years of age. Figure 102 also shows that most (78%, or 381) of the poisoning victims were male.

Figure 134. Age and gender distribution of poisoning victims in Hawaii, 2007-2011.

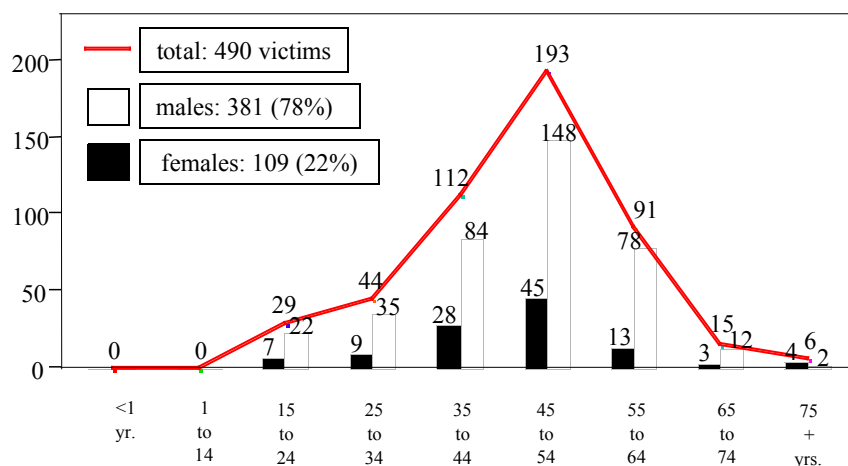
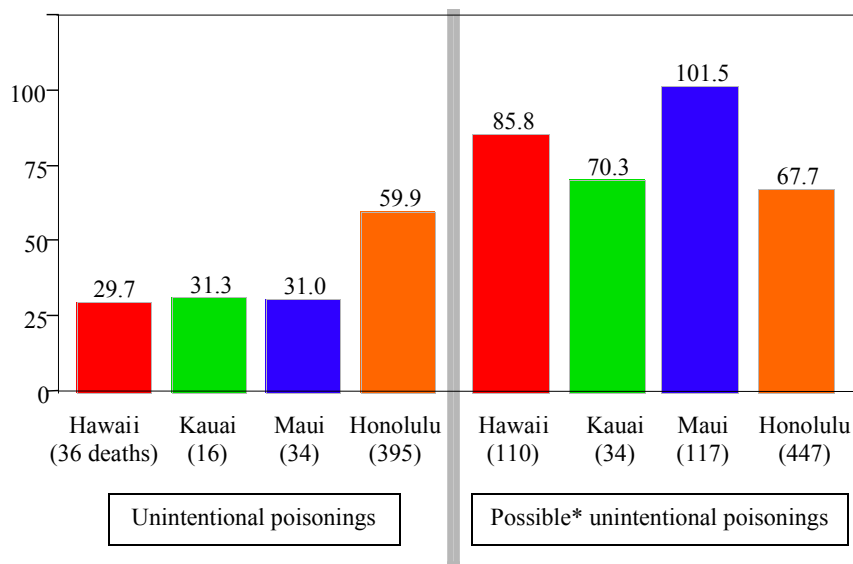


Figure 135 shows the uncertainty of comparing poison fatality rates across the counties of Hawaii, given the differences in the coding of intent. If only those poisonings that were coded as unintentional are considered, the rate was significantly higher among residents of Honolulu County compared to any other county, while the rates across Neighbor Islands were all statistically comparable. However, if poisonings of undetermined intent are also included (right side of Figure 135), the rate for Honolulu County residents was significantly lower than the rates for residents of Hawaii or Maui counties.

Figure 135. Five-year rates (/100,000) of unintentional poisonings and possible* unintentional poisonings, by county, 2007-2011.

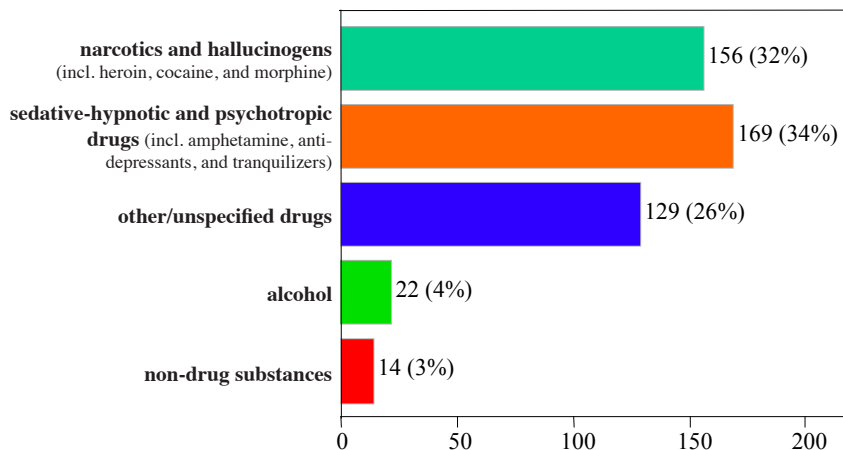
(Includes residents aged 20 years and older. Rates are age-standardized to the 2000 U.S. population distribution)



*Sum of poisonings of unintentional and undetermined intent.

Almost all (93%, or 454) of the 490 unintentional poisonings were drug-related (Figure 136). One-fourth (129 deaths) were classified as “other” or “unspecified” drugs, but there were two other major categories: 1) narcotics, and 2) sedative-hypnotic and psychotropic drugs. The former category includes most of the illicit substances, like heroin, cocaine, and morphine. The latter category includes amphetamine, antidepressants, barbiturates, and tranquilizers. Deaths among residents of Neighbor Islands were much more likely to be coded as due to “other” or “unspecified” drugs, compared to deaths among residents of Honolulu County (53% vs. 20%). The increasing trends shown in Figure 101 were apparent for all 3 categories of drugs. The 22 alcohol poisonings were approximately double 12 resident fatalities recorded over the preceding 16-year period from 1991 to 2006. Most of these victims (59%, or 13) were males in the 45 to 64 years age range; only 1 of the 22 victims was under 21 years of age.

Figure 136. Fatal poisonings among Hawaii residents, by type, 2007-2011.



Nonfatal injuries

There was an increasing trend in the annual number of nonfatal poisonings treated in EDs, but no trend for those requiring hospitalization (Table 30). The increasing trend in ED visits was apparent for residents of all counties except Kauai. Gender was nearly equally distributed for both settings, with males in a slight majority (52% overall). Patients who were hospitalized were significantly older than those who were treated in EDs (mean age: 47 vs. 30 years, respectively). More than one-quarter (28%) of those who were treated in EDs were under 5 years of age (compared to 9% of hospitalized patients), and only 9% were in the senior age range. Age was more broadly distributed among hospitalized patients, although there was also a peak in the toddler age range; 8% were 1 to 3 years of age. Honolulu County residents comprised more than two-thirds (68%) of the hospitalized patients.

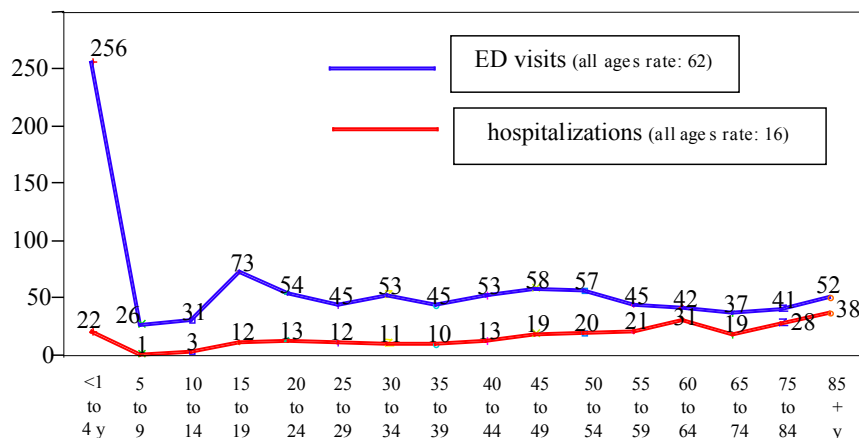
Table 30. Demographic characteristics* of Hawaii residents with nonfatal poisonings.

	ED visits	hospitalizations	total
Year of admission			
2007	780	198	978
2008	753	197	950
2009	797	231	1028
2010	833	204	1037
2011	860	204	1064
average annual total	805	207	1011
Patient gender			
Female	384 (48%)	97 (47%)	481 (48%)
Male	421 (52%)	110 (53%)	530 (52%)
Patient age			
infants	26 (3%)	2 (1%)	28 (3%)
1-4 y	199 (25%)	17 (8%)	217 (21%)
5-14 y	45 (6%)	3 (1%)	47 (5%)
15-24 y	110 (14%)	22 (11%)	132 (13%)
25-34 y	90 (11%)	21 (10%)	111 (11%)
35-44 y	85 (11%)	19 (9%)	104 (10%)
45-54 y	105 (13%)	35 (17%)	141 (14%)
55-64 y	68 (9%)	40 (19%)	109 (11%)
65-74 y	34 (4%)	17 (8%)	51 (5%)
75-84 y	27 (3%)	19 (9%)	46 (5%)
85+ y	15 (2%)	11 (5%)	27 (3%)
County of residence of patient			
Hawaii	155 (19%)	37 (18%)	193 (19%)
Honolulu	502 (62%)	141 (68%)	643 (64%)
Kauai	59 (7%)	13 (6%)	72 (7%)
Maui	88 (11%)	15 (7%)	103 (10%)

*Statistics are annual averages over the 2007-2011 period.

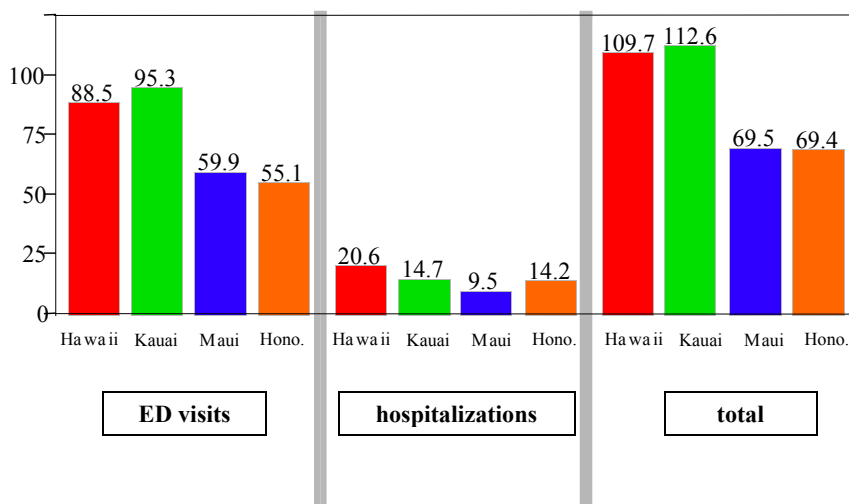
Rates of ED visits were highest by far for residents under 5 years of age, nearly 5 times higher than the rate for almost all other age groups (Figure 137). Rates were low among residents 5 to 14 years of age, were elevated across the 15 to 54 year age group, before generally decreasing across older residents. Residents aged 5 to 14 years also had the lowest rates of hospitalizations, which generally increased among succeeding age groups.

Figure 137. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for nonfatal poisonings in Hawaii, by age of patient, 2007-2011.



Residents of Honolulu and Maui counties had comparable rates of both ED visits and total (ED visits combined with hospitalizations) non-fatal poisonings (Figure 138). These rates were significantly higher among residents of Hawaii and Kauai counties. The total rate for Oahu and Maui County residents was 37% lower than for residents of Kauai County, and 38% lower than the rate for Hawaii County residents. Maui County residents had a significantly lower rate of hospital admissions for poisonings than Hawaii County residents. Otherwise, hospitalization rates were comparable across all counties.

Figure 138. Age adjusted annual rates (per 100,000 residents) of nonfatal poisonings, by level of care and county of residence of patient, 2007-2011.



Patients were hospitalized for slightly over 3 days on average, and hospitalizations comprised 45% of the total number of days of care (Table 31). The average charge for a hospitalization was nearly \$18,000, however, over 11 times the average charge for an ED visit. Hospitalizations therefore comprised most (77%) of the total annual charges of \$4.8 million. Most (76%) of the poisonings were caused by drugs or medicinal substances, including 92% of those that required hospitalization. Poisonings from drugs or medicinal substances were particularly common among senior-aged patients (86%). Narcotics caused 21% of the hospitalizations, tranquilizers 13%, aromatic analgesics (which include acetaminophen, or Tylenol) 8%, and cardiovascular agents 8%. The type of drug was more widely distributed among the ED visits, although aromatic analgesics (7%), tranquilizers (7%), and narcotics (8%) were among the most commonly coded.

Table 31. Clinical characteristics* of Hawaii residents with nonfatal poisonings.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	3.1	1.4
Total number of days	805	647	1452
Average charge	\$1,604	\$17,766	\$4,715
Total charges	\$1.29 million	\$3.67 million	\$4.77 million
E-code classifications			
Drugs and medicinal substances			
heroin	7 (1%)	1 (1%)	8 (1%)
methadone	6 (1%)	9 (4%)	15 (1%)
other opiates & related narcotics	51 (6%)	34 (16%)	85 (8%)
salicylates (incl. aspirin)	8 (1%)	6 (3%)	13 (1%)
aromatic analgesics (incl. acetaminophen)	54 (7%)	16 (8%)	69 (7%)
other analgesics/antipyretics	34 (4%)	5 (2%)	39 (4%)
sedatives and hypnotics	24 (3%)	8 (4%)	31 (3%)
tranquilizers	54 (7%)	27 (13%)	82 (8%)
other psychotropic agents	49 (6%)	15 (7%)	65 (6%)
anticonvulsants	10 (1%)	10 (5%)	20 (2%)
other depressants	19 (2%)	5 (3%)	24 (2%)
anaesthetics (incl. cocaine)	2 (0%)	0 (0%)	3 (0%)
antibiotics	9 (1%)	0 (0%)	9 (1%)
hormones and synthetics	27 (3%)	13 (6%)	40 (4%)
cardiovascular agents	32 (4%)	16 (8%)	48 (5%)
other drugs/medical substances	191 (24%)	25 (12%)	217 (21%)
Non-medicinal substances			
alcohol	23 (3%)	6 (3%)	29 (3%)
cleaners and paints	20 (3%)	1 (0%)	21 (2%)
petroleum products	22 (3%)	2 (1%)	24 (2%)
insecticides/animal poisons	19 (2%)	1 (0%)	20 (2%)
other non-medicinal substances	64 (8%)	4 (2%)	68 (7%)
toxic foods	38 (5%)	2 (1%)	40 (4%)
gases and vapors	41 (5%)	2 (1%)	43 (4%)

*Statistics are annual averages over the 2007-2011 period.

Suffocations

Fatal injuries

There were 149 suffocations between 2007 and 2011, with the annual total varying inconsistently between 29 and 37 deaths (Figure 139). There were also no apparent trends within victim age groups. Most (89%, or 132) of these injuries occurred on Oahu, 10 on Hawaii, 5 in Maui County, and 2 on Kauai. Most (92%, or 93) of the 101 deaths among senior-aged victims also occurred on Oahu. The adjusted all-ages fatality rate was significantly greater for Oahu residents (12 deaths/100,000 residents) compared to residents of the Neighbor Islands (4 deaths/100,000), as were senior-aged fatality rates (69 vs. 15 deaths/100,000 residents, respectively).

Figure 139. Annual number of fatal suffocations among Hawaii residents, by county, 2007-2011.

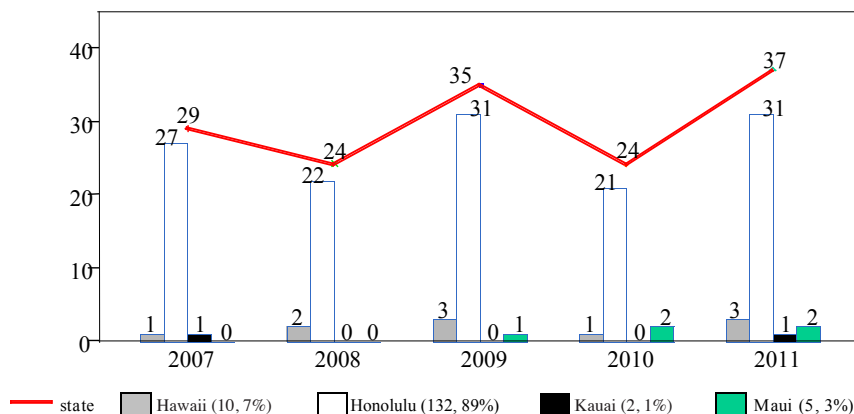
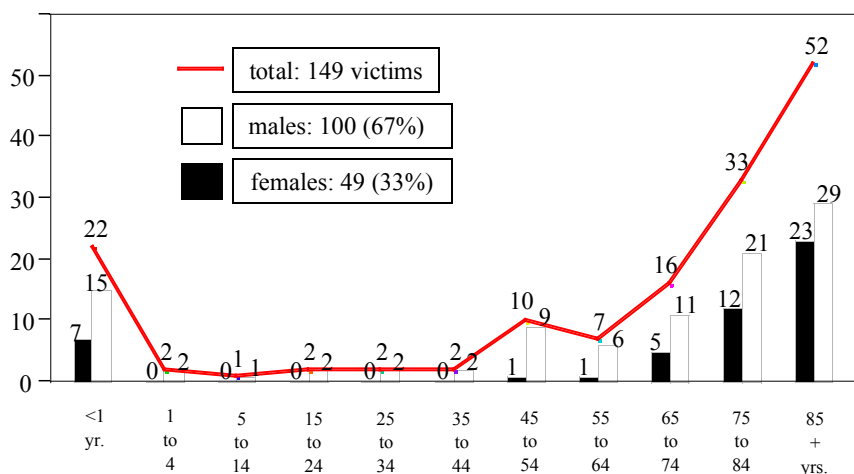


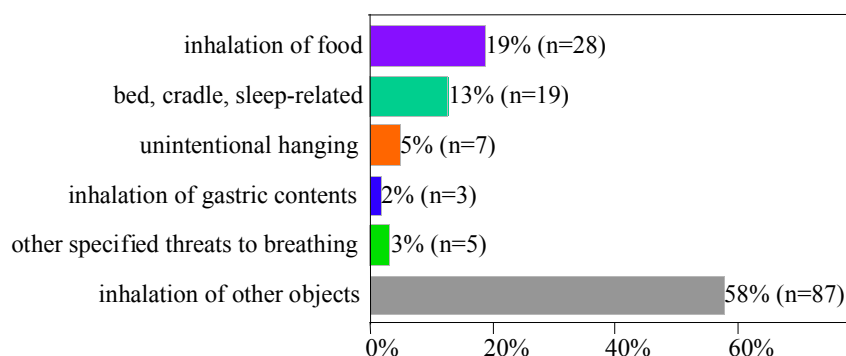
Figure 140 shows there were two predominant age groups among the suffocation victims: infants and those over age 65. Twenty-four (16%) of the victims were either infants (22 victims) or 1 to 3 year-olds (2 victims), and 101 (68%) were 65 years of age or older, including 52 (35%) who were 85 years or older. Males comprised two-thirds (67%) of the victims.

Figure 140. Age and gender distribution of victims of suffocation in Hawaii, 2007-2011.



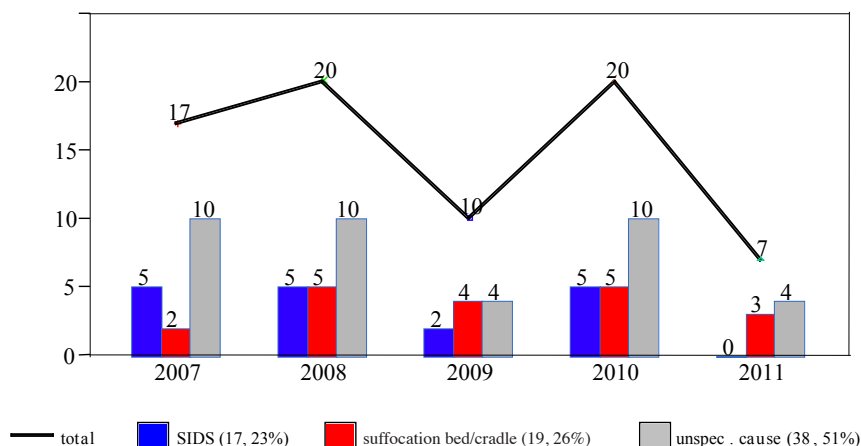
About one-fifth (21%) of the suffocations were caused by the inhalation of food (19% of deaths) or gastric contents (2%) (Figure 141). There was little additional detail on what types of foods were involved in the deaths. Most (68% or 21) of these 31 victims were 65 years or older. More than half (58%, or 87) of all suffocations were caused by the inhalation of “other” objects, again, with little additional information. Almost all (91%, or 79) of these 87 victims were seniors, including half (51%, or 44) who were 85 years or older. All 19 of the victims who suffocated in a bed or cradle were infants. All but 1 of these victims were 4 months of age or younger, including 8 (42%) who were 1 month or less old. Most (84%, or 16) of these 18 infants were residents of Honolulu County.

Figure 141. Suffocations among Hawaii residents, by type, 2007-2011.



Because infant suffocations can be coded as Sudden Infant Death Syndrome (SIDS), or “other ill-defined and unspecified causes of mortality” (code R99), annual trends for all 3 types of infant deaths were examined (Figure 142). Deaths coded as and “unspecified causes” (38) outnumbered those coded as suffocations in bed or cradle (19), or SIDS (17). There were no consistent trends in the annual number of these potentially sleep-related deaths among infants, which varied inconsistently from 7 to 20. Deaths among infant residents of Hawaii County were much more likely to be coded as SIDS (7 of 9, or 78%), compared to residents of other counties (18% to 24%). Most (82%, or 61) of the 74 total decedents were under 5 months of age, although this proportion was higher for those deaths coded as suffocations (95%).

Figure 142. Annual number of sleep-related or possibly sleep-related deaths among infant residents of Hawaii, by type, 2007-2011.



Nonfatal injuries

There was a decreasing trend in the overall number of nonfatal suffocations in the state, due mostly to decreases in ED visits over the 2008-2010 period (Table 32). This decrease was evident only among residents of Honolulu and Maui counties, however. Gender was nearly equally distributed, with a slight majority (53%) of male patients overall. A large proportion (7%) of patients were infants, including 13% of those who were hospitalized. Residents 1 to 4 years of age comprised half (50%) of the patients treated in EDs and 7% of those who were hospitalized. Seniors also made up a large portion (58%) of hospitalized patients, including 35% who were 85 years or older. Oahu residents comprised 59% of the patients. There were nearly twice as many patients from Maui County compared to Hawaii County, despite a lower population in the former. Rates of ED visits for nonfatal suffocations were significantly higher among residents of Neighbor Islands (14 visits per year/100,000 residents) compared to Oahu residents (9 visits/100,000). Hospitalization rates were statistically comparable, although this comparison is limited by the small numbers.

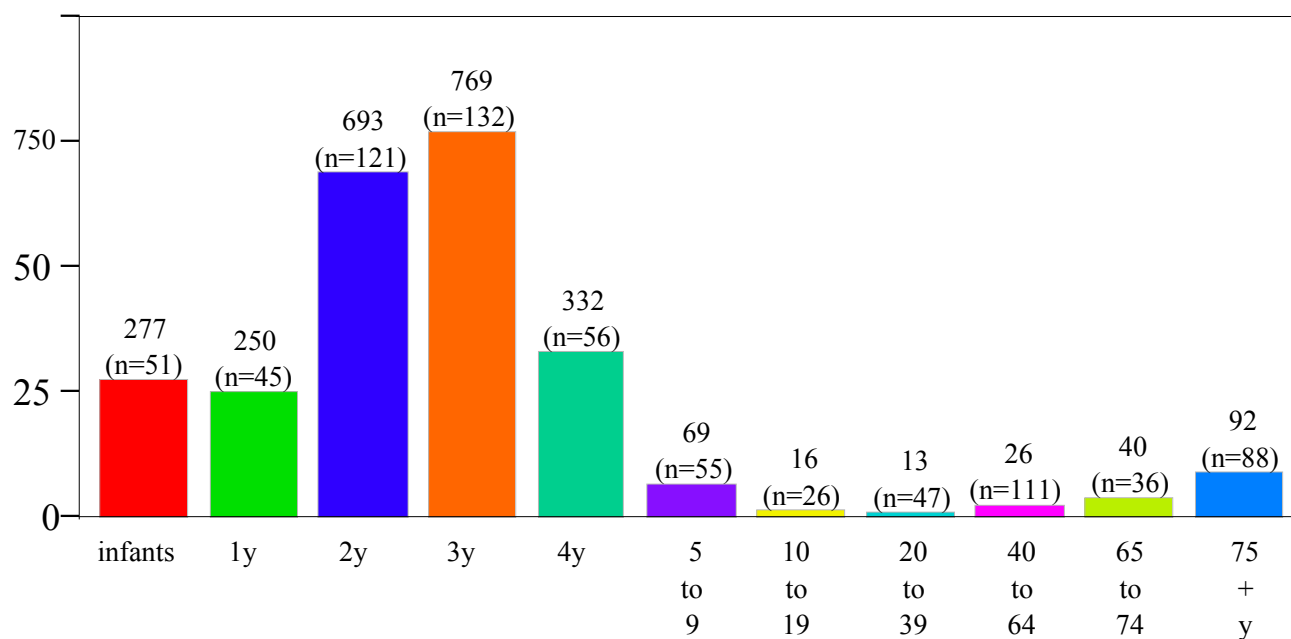
Table 32. Demographic characteristics* of Hawaii residents with nonfatal suffocations.

	ED visits	hospitalizations	total
Year of admission			
2007	181	16	197
2008	184	12	196
2009	123	14	137
2010	102	14	116
2011	106	16	122
average annual total	139	14	154
Patient gender			
Female	65 (47%)	7 (47%)	72 (47%)
Male	74 (53%)	8 (53%)	81 (53%)
Patient age			
infants	8 (6%)	2 (13%)	10 (7%)
1-4 y	70 (50%)	1 (7%)	71 (46%)
5-14 y	13 (9%)	1 (6%)	14 (9%)
15-24 y	5 (4%)	0 (0%)	5 (3%)
25-34 y	4 (3%)	0 (1%)	5 (3%)
35-44 y	5 (4%)	0 (1%)	6 (4%)
45-54 y	8 (6%)	1 (6%)	9 (6%)
55-64 y	8 (6%)	1 (8%)	9 (6%)
65-74 y	6 (4%)	1 (8%)	7 (5%)
75-84 y	6 (4%)	2 (15%)	8 (5%)
85+ y	5 (3%)	5 (35%)	10 (6%)
County of residence of patient			
Hawaii	16 (11%)	3 (18%)	18 (12%)
Honolulu	83 (59%)	9 (64%)	92 (60%)
Kauai	10 (7%)	0 (3%)	10 (7%)
Maui	31 (22%)	2 (15%)	33 (21%)

*Statistics are annual averages over the 2007-2011 period.

Nonfatal suffocation rates were highest for residents under 5 years of age, with a peak among 2 and 3 year-olds (Figure 143). (These rate estimates combine injuries treated in ED and inpatient settings, since there were too few of the latter for separate calculations.) Rates increased across successive age groups among residents 20 years and older, although on a much lower scale than for children under 5 years of age.

Figure 143. Five-year rates (per 100,000 residents) of nonfatal suffocations in Hawaii, by age of patient, 2007-2011.



Most (78%) of the total days of care were comprised of ED visits, as hospitalizations were only for 2.7 days on averages (Table 33). However, the average medical charge for each hospitalization was nearly \$13,000, so hospitalizations contributed 67% of the annual total of \$0.3 million in charges. According to E-codes, 61% of the hospitalizations were caused by inhalation of food and less commonly (33%) by inhalation of other (non-food) objects. Non-food objects caused 61% of the ED visits for nonfatal suffocations, while inhalation of foods caused 38%. Almost all (97%) the suffocations were diagnosed as “foreign body entering through orifice”. The nose (50%) was the most common entry point for suffocations treated in EDs, while the larynx (38%), esophagus (24%) and other parts of the respiratory tree (24%) were the most common locations for suffocations requiring hospitalizations. Suffocations from foods were usually located in the pharynx (31%) and larynx (29%), while most (78%) non-food suffocations were located in the nose.

Table 33. Clinical characteristics* of Hawaii residents with injuries from nonfatal suffocations.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	2.7	1.2
Total number of days	139	39	178
Average charge	\$1,018	\$12,841	\$2,042
Total charges	\$0.1 million	\$0.2 million	\$0.3 million
E-code classifications			
inhalation of food	53 (38%)	9 (61%)	62 (40%)
inhalation of other objects	84 (61%)	5 (33%)	89 (58%)
other/unspecified	2 (1%)	1 (6%)	2 (2%)
Primary injury diagnosis			
foreign body	136 (97%)	13 (93%)	149 (97%)
nose	70 (50%)	0 (0%)	70 (46%)
pharynx	20 (14%)	1 (7%)	21 (14%)
larynx	22 (16%)	5 (38%)	27 (18%)
respiratory tree	2 (2%)	3 (24%)	6 (4%)
esophagus	12 (8%)	3 (24%)	15 (10%)
digestive tract, unspec.	10 (7%)	0 (0%)	10 (7%)
other/unspecified	4 (3%)	1 (7%)	5 (3%)

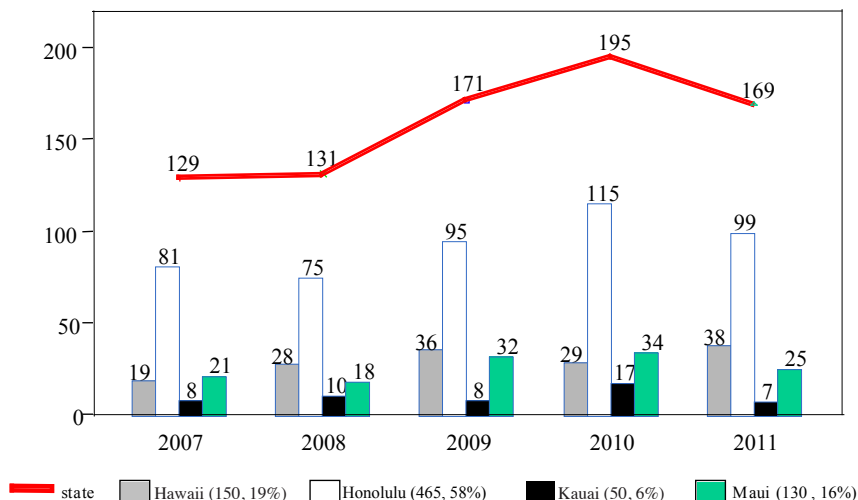
*Statistics are annual averages over the 2007-2011 period.

Suicides

Fatal injuries

Suicide was the single leading cause of fatal injuries among state residents, accounting for 24% of the total number of victims. There were 795 suicides among state residents over the 5-year period, with an increasing trend in the annual number (Figure 144). The 195 deaths in 2010 was by far the highest total in the 19-year period (1991-2009) for which data was available. Most (58%, or 465) of the suicides occurred among residents of Oahu. Increasing trends were evident for residents of all counties, although the total decreased from 2010 to 2011 for all but Hawaii County. The interpretation of annual trends for both the state and individual counties requires consideration of trends in the number of fatal injuries of undetermined intent (i.e. possible suicides, or less commonly, possible homicides), although those did not change much over the 5-year period (Figure 168).

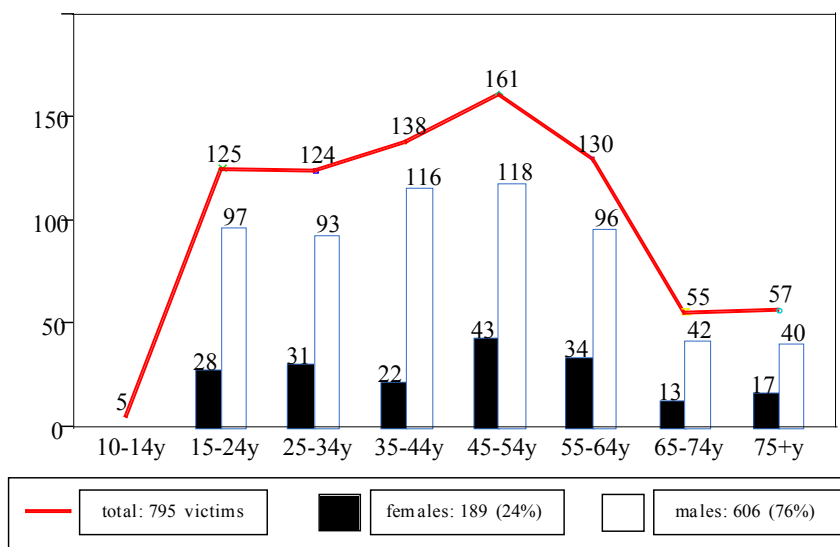
Figure 144. Annual number of suicides among Hawaii residents, by county of residence, 2007-2011.



The youngest aged victims were 10 years old, but almost all (95%, or 758) were 19 years or older (Figure 145). Victim age was widely distributed, with 74% (592) in the wide range of 20 to 60 years of age. The increasing trend (Figure 144, above) was evident in all age groups in the 15 to 74 year age range.

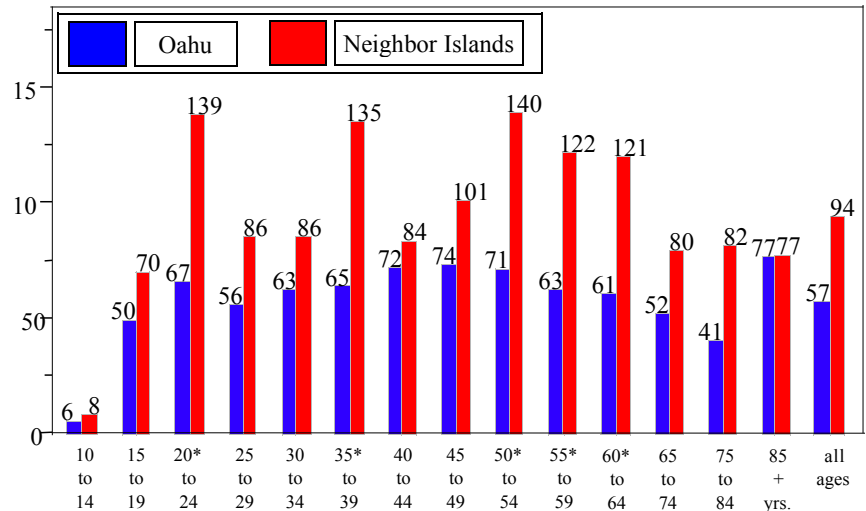
The figure also shows that male victims (606) outnumbered females (189) by a 3-to-1 ratio. That ratio was fairly constant across the age ranges, although smaller among the 37 victims who were 18 years or younger (25 males and 12 females). There was an increasing trend in annual number of both male and female victims, with the 2010 totals being the highest since at least 1991 for either gender (46 females, 159 males). Fatality rates were highest for 45 to 54 year olds and residents aged 85 years and older (see Figure 20).

Figure 145. Age and gender distribution of victims of suicides in Hawaii, 2007-2011.



Although 58% of the victims were residents of Oahu, the overall age adjusted rate (57.5 suicides/100,000) was 39% lower compared to that for residents of the Neighbor Islands (94.5). The rates for each of the other 3 counties were statistically comparable, ranging only from 85.5/100,000 (Kauai County) to 98.6 (Hawaii County). (The rate for Maui County was 94.9/100,000 residents.) Figure 146 shows that suicide rates for Neighbor Island residents were higher than those for Oahu residents for most age groups, particularly for those 50 to 64 years of age.

Figure 146. Five-year rates (/100,000) of suicide among residents of Oahu, and Neighbor Islands, by age group, 2007-2011.

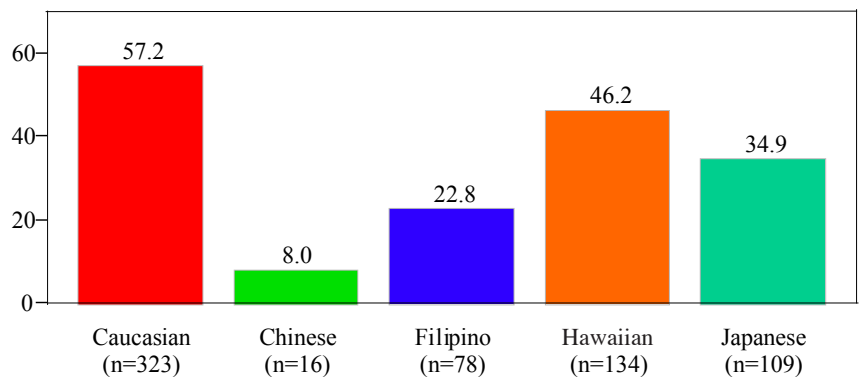


*Indicates significant difference in rates between residents of Oahu and Neighbor Islands.

Chinese residents had significantly lower suicide fatality rates than any of the other ethnic groups, although the rate was based on only 16 deaths (Figure 147). The rate was also low for Filipino residents, significantly lower than all but the rate for Chinese residents. The highest rate was computed for Caucasian residents, significantly higher than any group, other than Hawaiians.

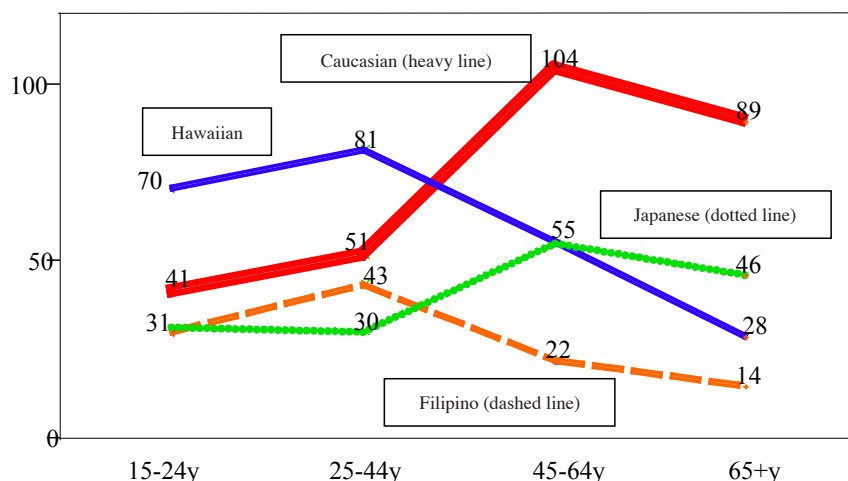
Figure 147: Unadjusted rates (per 100,000) of suicides, by ethnicity, 2007-2011.

(Number of suicides given in parentheses in bottom labels.)



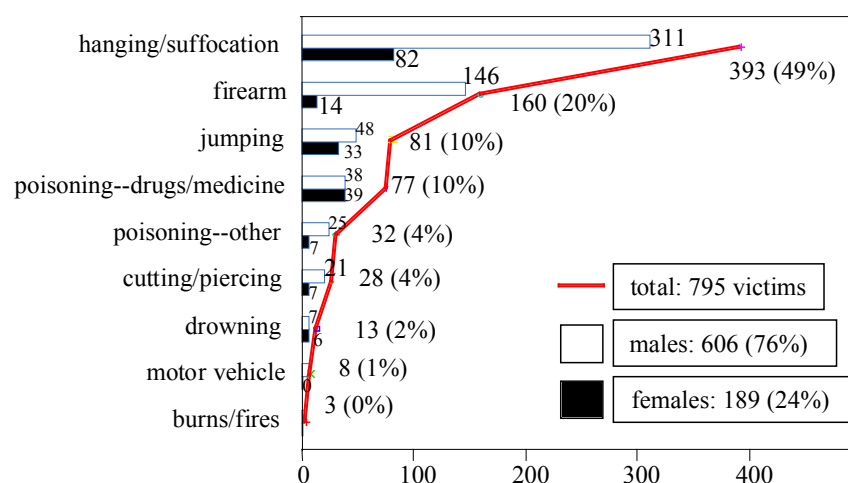
Suicide rates were computed for different age groups within the 4 ethnicities with at least 75 deaths (Figure 148). Hawaiians had the highest rates for 15 to 24 year-old and 25 to 44 year-old residents, significantly higher than any other ethnic group, but a relatively rate for senior-aged residents. The rates for 45 to 64 year-old residents and those aged 65 and older were significantly higher for Caucasians than any other ethnic group. The rates for Caucasians in these latter two age groups were approximately 2 to 5 times higher than the rates for the other 3 ethnicities. Hawaiians and Filipinos had generally similar patterns with peak rates in the 25 to 44 year age group, and lower rates for older age groups, although rates were higher among Hawaiian residents at every age group. Suicide rates were computed for different age groups within the 4 ethnicities with at least 75 deaths (Figure 148). Hawaiians had the highest rates for 15 to 24 year-old and 25 to 44 year-old residents, significantly higher than any other ethnic group, but a relatively rate for senior-aged residents. The rates for 45 to 64 year-old residents and those aged 65 and older were significantly higher for Caucasians than any other ethnic group. The rates for Caucasians in these latter two age groups were approximately 2 to 5 times higher than the rates for the other 3 ethnicities. Hawaiians and Filipinos had generally similar patterns with peak rates in the 25 to 44 year age group, and lower rates for older age groups, although rates were higher among Hawaiian residents at every age group.

Figure 148: Suicide rates (per 100,000) among residents of Hawaii, by age group and ethnicity, 2007-2011.



The most common mechanism of suicide was by hanging or suffocation, which accounted for about half (49%) of the deaths (Figure 149). Use of firearms was the second most common method, although it accounted for a much higher proportion of the suicides among males (24%), than among females (7%). Other major mechanisms included jumps from high places (10%), and poisoning from medicinal substances (10%). Besides firearms, male victims were more likely to die by hangings/suffocations (51%), compared to female victims (43%), while females were more likely than males to use medicinal substances (21% vs. 6%, respectively). Firearms were more commonly used among Neighbor Island victims (26%) than those on Oahu (16%), while the latter were more likely to have jumped from a high place (15% vs. 3% for Neighbor Island victims). Victims of hangings or suffocations (mean age 40 years) were significantly younger than other victims (50 years of age).

Figure 149. Suicides among male and female residents of Hawaii, by mechanism, 2007-2011.

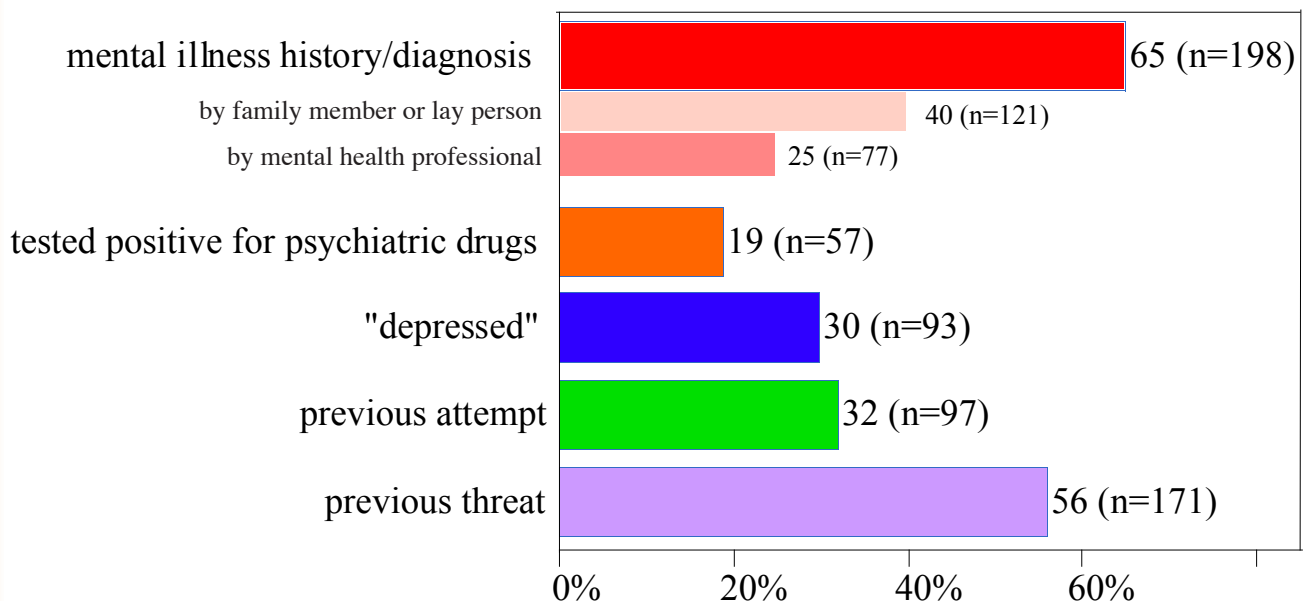


Efforts were made to review all Honolulu County autopsy records for suicide victims for years 2008 through 2010, and a random selection of 2007. Almost all (97%, or 306) of the 314 eligible records were reviewed. Manifestations of mental illness were commonly documented in these records. Figure 150 shows that almost two-thirds (65%, or 198) of the victims had a documented history of mental illness, most commonly mood disorders (178 victims, 58%), psychoses (31, 10%), or anxiety disorders (27, 9%). (These percentages add to more than 65% because 39 victims had more than 1 type of mental illness.) A mental illness diagnosis was provided by a psychiatrist, psychologist or mental health case worker for 25% (77) of the victims. Mental illness was described by a surviving spouse or intimate partner for 10% (32), by another family member for 23% (70%), by other lay person for 4% (13), and by an unknown source for the remaining 2% (6 victims). Only about one-third (32%, or 63) of the victims described as mentally ill were in treatment near the time of the suicide. Another 11 victims (6%) had been in treatment

at earlier points in their lives. Barriers to mental health treatment were described for 24 of the victims, most commonly their non-compliance with medications (10) and/or refusal of treatment or therapy (15). Concerns over insurance were noted for only 2 of the mentally ill victims.

About one-fifth (19%, or 57) of the victim tested positive for psychiatric drugs, including benzodiazepines (42 victims), anti-depressants (17), anti-psychotics (6), and anxiolytics (5). (Note: it is possible that the drugs labeled for “psychiatric” uses in this report, were actually prescribed for other purposes, e.g. as anti-convulsants, or muscle relaxants.) The proportion who tested positive for these substances was higher among those described as mentally ill (25%), particularly those diagnosed by a mental health professional (31%). Thirty-percent (93) of the victims were described by survivors as “depressed” before the suicide, 56% had verbally threatened suicide, and nearly one-third (32%) had made a previous attempt.

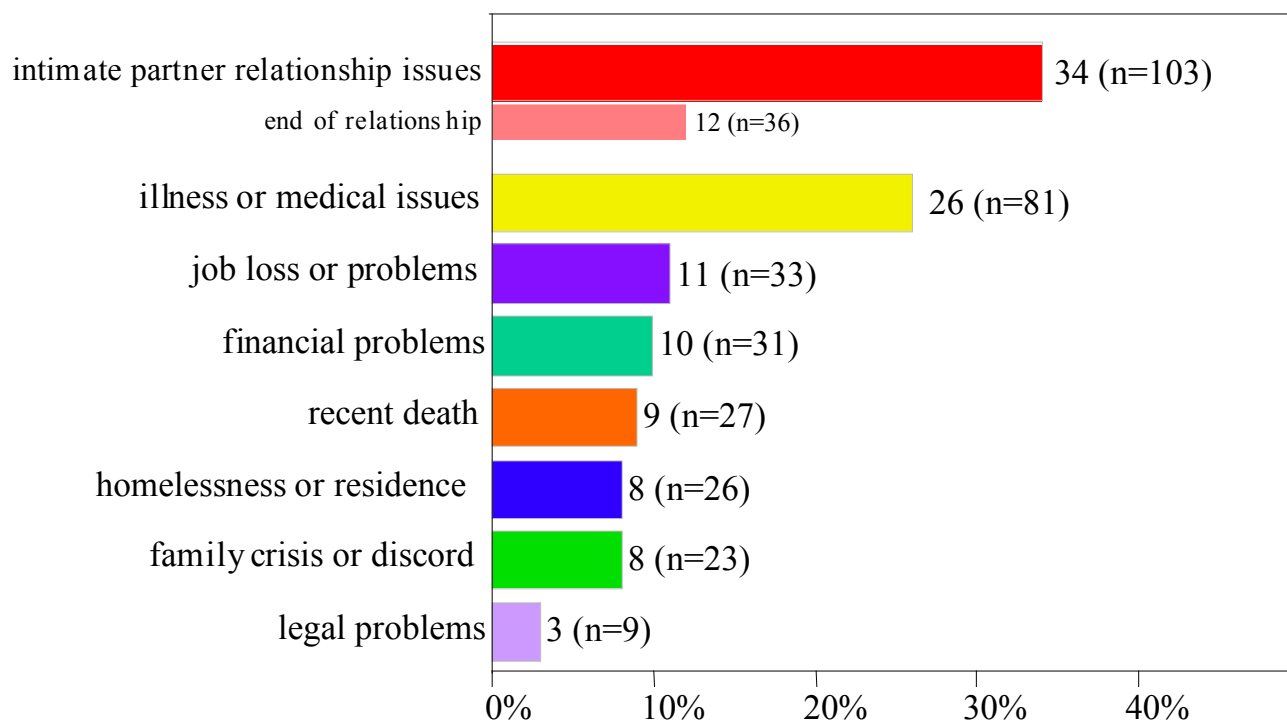
Figure 150. Documentation of “mental illness” among suicide victims in Honolulu County, 2007-2010.



At least one negative life event was documented in the autopsy records of more than two-thirds (72%, or 219) of the 306 victims (Figure 151). The most common negative events were intimate partner relationship problems (34%, or 103 victims). About one-third (36) of these victims specifically had issues with the endings of relationships. Relationship issues were most common among victims under 50 years of age (44%, or 87 of 197 victims). Serious illness was documented for about one-quarter (26%) of the victims overall, and one-half (60%, or 29 of 48 victims) of senior-aged victims. Problems at work (including loss of job), financial problems, bereavement, homelessness or residence issues, and family crises or discord were documented for 11% to 8% of the victims. Among the 24 victims under the age of 21, the most prevalent negative life events were intimate relationship issues (11 victims, or 46%), family problems (4), and bereavement (4). Only 1 of these victims had documented issues related to school. There was no significant difference in

the overall proportion of male victims with a documented negative event, compared to female victims (71% vs. 72%). There were also few gender differences in the type of negative life events, other than male victims were significantly more likely to have had end of relationship issues (14% vs. 5% for females) or the loss of a job (10% vs. 5%) as negative events, while females were somewhat more likely to have had a serious illness or medical issues (31% vs. 25% for males).

Figure 151. Negative life events documented in the autopsy records of suicide victims in Honolulu County, 2007-2010.

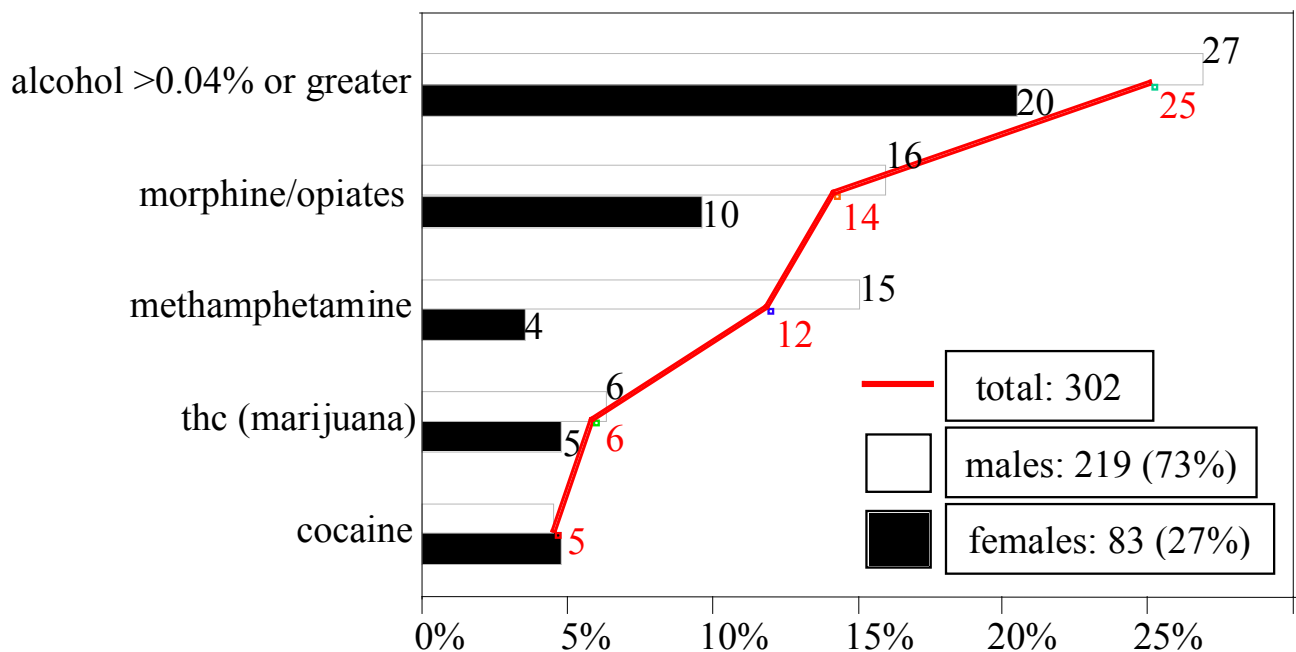


The toxicology results from autopsy records from 2007-2010 are summarized in Figure 152. (These percentages exclude 4 (1% of 306) victims who were not tested or for whom test results were not available.) One-quarter (25%, or 75) of the victims had BAC of 0.04% or greater, including 57 (19%) with BAC of 0.08% or greater, the level used to indicate inebriation among drivers in Hawaii. (These proportions were similar if only victims aged 21 years and older are considered: 26% and 20%, respectively.) About 11% (32) of the victims had BAC levels of 0.16% or greater (i.e. twice the legal limit). Males and females were statistically comparable in the proportion of victims with BAC levels of 0.04% or greater, and the proportion who were legally intoxicated. Victims who were legally intoxicated were significantly younger, on average, than victims who tested negative for alcohol (39 vs. 47 years of age, respectively).

Toxicologic exams identified illicit drugs in the blood of about one-third (34%, or 103) of the victims.

(The term “illicit” here includes thc, cocaine, methamphetamine, as well as morphine and opiates, which also have medicinal uses.) This proportion was significantly higher among male victims (39%) compared to female victims (22%). The most commonly identified drugs were opiates, present in 14% (43) of the victims, followed by methamphetamine (12%), cocaine (5%), and marijuana (6%). Male victims were significantly more likely to test positive for methamphetamine (15%), compared to female victims (4%). Eleven (4%) of the victims tested positive for more than one of the drug groups at the time of autopsy. The average age of victims who had used drugs was significantly younger than that of those who had not (42 vs. 47 years, respectively), although there was a wide age distribution (standard deviation 15 years) among the drug users. There were no significant associations between alcohol use and the prevalence of illicit drugs, which was 33% for victims who were negative for alcohol, and 37% for those with a BAC of 0.04% or higher. (This proportion was 28% for the 18 victims with a BAC between 0.01% and 0.03%.)

Figure 152. Presence of alcohol or illicit drugs in the blood of suicide victims in Honolulu County, by gender, 2007-2010.



Apart from the toxicology results, over one-third (37%, or 112) of the 306 victims had a documented history of substance abuse. The most commonly abused substances were alcohol (24%, or 73 victims), methamphetamine (13%, or 40 victims), cocaine (4%, or 12 victims), and prescription drugs (4%, or 13 victims). Substance abusers were significantly younger than the other victims (mean age: 41 vs. 47 years).

Nonfatal injuries

There was an increasing trend in the annual number of nonfatal suicide attempts overall, although this was evident only for ED visits (Table 34). (There were 5 patients under 10 years of age with E-codes indicating self-inflicted injuries. These 5 records were assumed to be erroneously coded and excluded from these analyses.) The number of injuries that required hospitalization were not much lower than the number treated in EDs, unlike most any other category of injury. The gender distribution of patients was similar for both settings, with females comprising a slight majority of patients. Slightly more than half (56%) of the patients were under 15 to 34 years of age, compared to only 31% of those who died from suicide over the 2007 to 2011 period. Proportionally more of the patients treated in EDs were in the 15 to 24 year age group (40%, compared to 27% of hospitalized patients), while there were more patients aged 45 years and older among those who were hospitalized (35%, vs. 18% of ED patients). About two-thirds (64%) of the patients were residents of Honolulu County. Among Maui County residents, patients who were hospitalized outnumbered those who were treated in EDs.

Table 34. Demographic characteristics* of Hawaii residents with nonfatal injuries from suicide attempts.

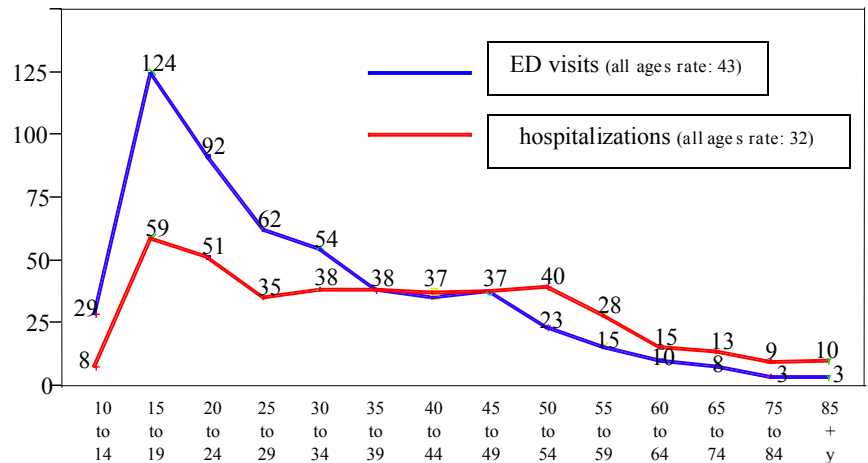
	ED visits	hospitalizations	total
Year of admission			
2007	424	352	776
2008	411	370	781
2009	448	392	840
2010	459	366	825
2011	585	323	908
average annual total	465	361	826
Patient gender			
Female	272 (58%)	198 (55%)	470 (57%)
Male	194 (42%)	162 (45%)	356 (43%)
Patient age			
10-14 y	22 (5%)	6 (2%)	28 (3%)
15-24 y	187 (40%)	96 (27%)	283 (34%)
25-34 y	108 (23%)	68 (19%)	177 (21%)
35-44 y	64 (14%)	64 (18%)	128 (15%)
45-54 y	55 (12%)	70 (19%)	125 (15%)
55-64 y	20 (4%)	35 (10%)	55 (7%)
65-74 y	7 (1%)	12 (3%)	18 (2%)
75-84 y	2 (0%)	6 (2%)	8 (1%)
85+ y	1 (0%)	3 (1%)	4 (0%)
County of residence of patient			
Hawaii	104 (22%)	61 (17%)	166 (20%)
Honolulu	285 (61%)	240 (67%)	525 (64%)
Kauai	47 (10%)	15 (4%)	61 (7%)
Maui	29 (6%)	45 (12%)	74 (9%)

*Statistics are annual averages over the 2007-2011 period.

Residents aged 15 to 19 years had the highest rates of hospitalizations and especially ED visits (Figure 153). Injury rates generally declined gradually from age 20, although the rate of hospitalizations changed little between 30 and 54 years of age. Residents aged 50 years and older were more likely to be hospitalized for nonfatal attempts than to be treated in ED settings.

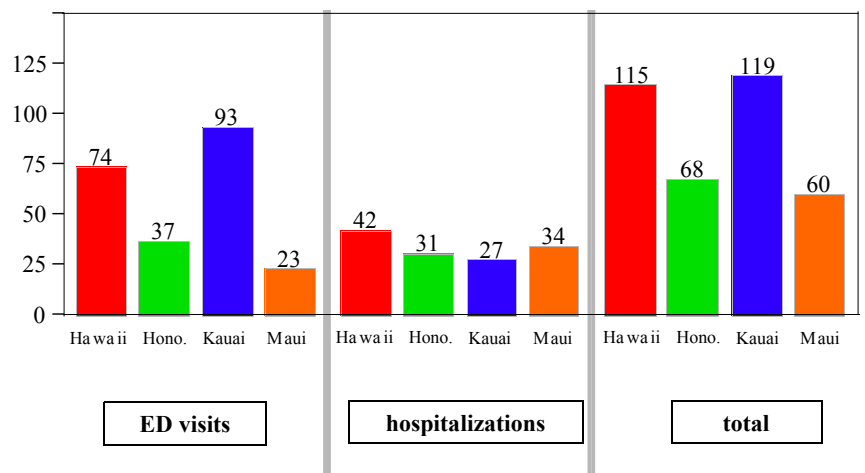
Female residents had significantly higher rates of both ED visits (53/100,000 residents) and hospitalizations (37/100,000) than male residents (34 and 28/100,000, respectively). However, these gender differences were only significant for the 10 to 14 and 15 to 19 year age groups for ED visits, and the 15 to 19 year age group for hospitalizations; male and female resident rate estimates were statistically comparable for all other age groups. If all nonfatal injuries (ED visits and hospitalizations combined) were considered, rates for females were also significantly higher in the 25 to 29 year age group.

Figure 153. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for nonfatal injuries from suicide attempts in Hawaii, by age of patient, 2007-2011.



Residents of Kauai and Hawaii counties had significantly higher rates of ED visits for nonfatal suicide attempts, compared to residents of Honolulu and Maui counties (Figure 154). The hospitalization rates were statistically comparable across counties, except for a significantly higher rate among Hawaii County residents compared to Honolulu County residents. The total rate (ED visits and hospitalizations combined) for residents of Kauai County was 75% higher than that for Oahu residents, and nearly double that for residents of Maui County. The total rate for Hawaii County residents was also significantly higher than the rates for residents of Honolulu and Maui counties, but comparable to the rate for Kauai County. These rate comparisons were complicated by injuries coded as undetermined intent, or possibly self-inflicted (see figure 172).

Figure 154. Age adjusted annual rates (per 100,000 residents) of nonfatal injuries from suicide attempts, by level of care and county of residence of patient, 2007-2011.

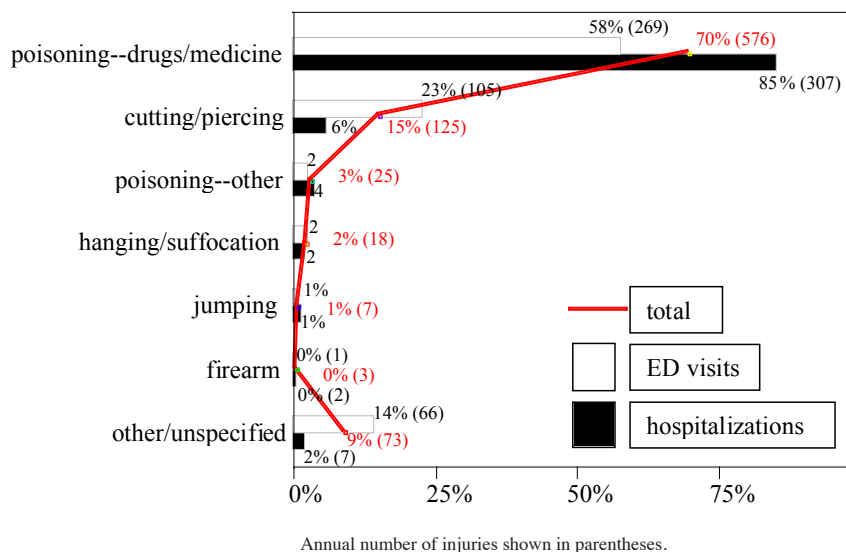


*Includes only residents aged 10 years and older.

Fifty-eight percent of the ED visits and most (85%) of the hospitalizations were caused by poisonings from drugs or medicinal substances (Figure 155). The most common poisonings were from the “analgesics, antipyretics, and anti-rheumatics” class (22% of ED visits, 33% of hospitalizations), which includes both narcotics (heroin, and other opiates), as well as aspirin and acetaminophen. Poisonings from “tranquilizers and other psychotropic agents” were also common, accounting for 16% of the ED visits and 29% of the hospital admissions. Injuries from cutting or piercing instruments comprised 15% of the attempts overall, including 23% of those treated in EDs. Very few of these nonfatal attempts were from hangings or use of firearms, reflecting the lethality of these mechanisms. Female patients

were more likely to attempt by drug or medicinal poisonings (76%, vs. 62% for male patients. There were few differences in mechanism across the county of residence of the patients.

Figure 155. Mechanism of nonfatal suicide attempts among Hawaii residents, by level of care, 2007-2011.



Patients were hospitalized for an average of nearly 5 days, so admissions constituted the bulk of days of patient care and total medical charges (Table 35). As described by mechanism, the majority (73%) of injuries were from poisonings, particularly for hospital admissions (89%). (These proportions do not exactly match those shown in Figure 124 because the former are based on E-codes, while these values are derived from diagnosis codes.) Open wounds and contusions or superficial injuries constituted most of the remaining ED visits.

Table 35. Clinical characteristics* of Hawaii residents with nonfatal injuries from suicide attempts.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	4.6	2.6
Total number of days	466	1,661	2,127
Average charge	\$2,727	\$22,330	\$10,771
Total charges	\$1.3 million	\$8.1 million	\$9.3 million
Primary injury diagnosis			
fractures	20 (4%)	6 (2%)	27 (3%)
open wounds	99 (21%)	14 (4%)	113 (14%)
contusion/superficial	46 (10%)	0 (0%)	46 (6%)
poisonings	279 (60%)	321 (89%)	600 (73%)
other/unspecified	21 (5%)	19 (5%)	40 (5%)

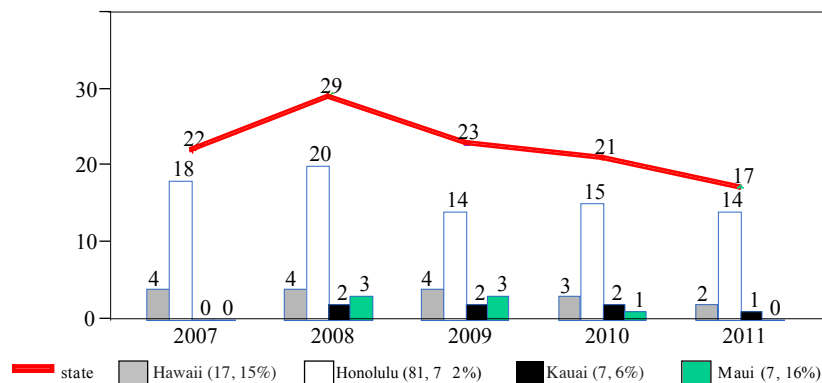
*Statistics are annual averages over the 2007-2011 period.

Homicides

Fatal injuries

There were 112 victims of homicide over the 5-year period, with a decreasing trend from 29 in 2008 to 17 in 2011 (Figure 156). The 112 victims died in 111 separate incidents, as only 1 incident claimed more than one life. The figure shows that the majority of victims (72%, or 81) were killed on the island of Oahu. More than half (55%, or 17) of the remaining 31 victims were killed on Hawaii, 7 in Maui County (1 on Lanai, the other 6 on the island of Maui), and 7 on Kauai. There were too few fatalities to compute county-specific rate estimates. 5-year age standardized fatality rates were statistically comparable across all counties, although these comparisons were based on small numbers for all but Honolulu County. The rate for Honolulu County residents (8.8/100,000 residents) was similar to that for residents of all Neighbor Islands (8.4/100,000).

Figure 156. Annual number of homicides among Hawaii residents, by county, 2007-2011.



Most (80%, or 90) of the victims were between 18 and 60 years of age, with a peak in the 35 to 44 year age group (Figure 157). There were also 2 infant victims and another 4 who were under 5 years of age. Males comprised a slight majority of the victims (66, or 59%), although gender was equally distributed among the youngest and oldest victims.

Figure 157. Age and gender distribution of homicide victims in Hawaii, 2007-2011.

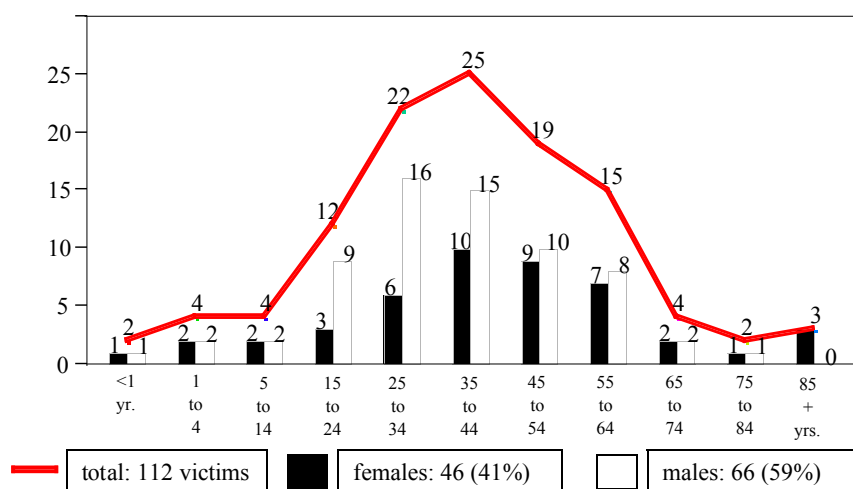
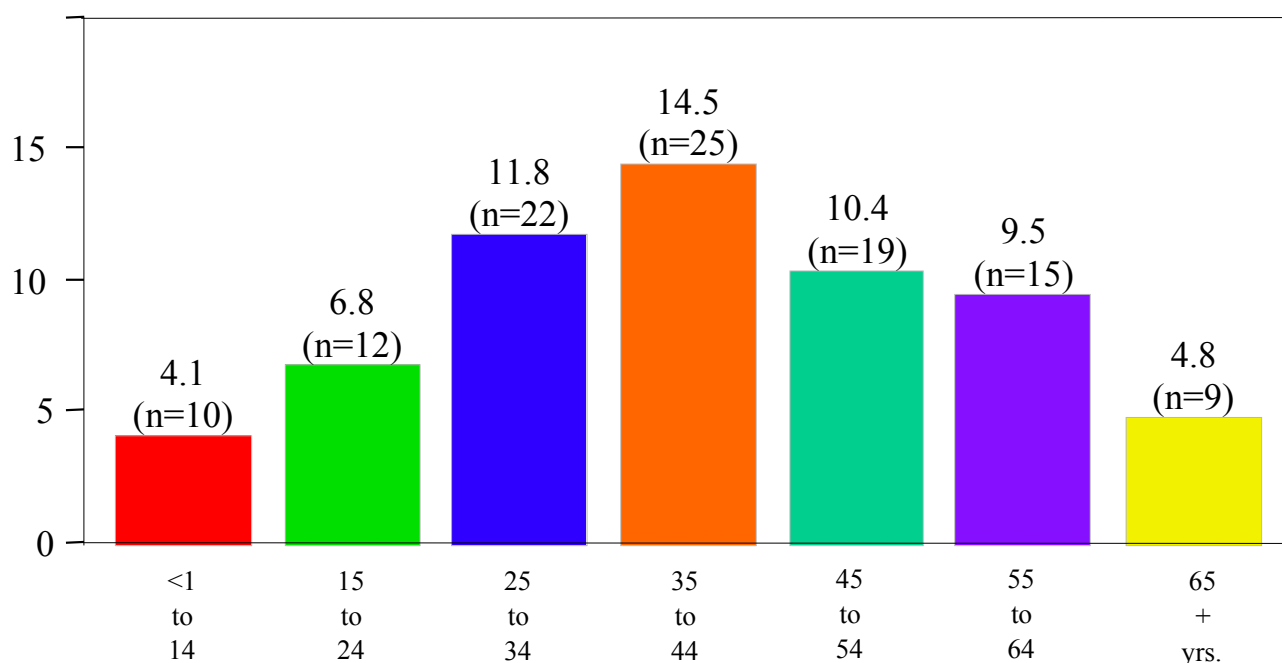


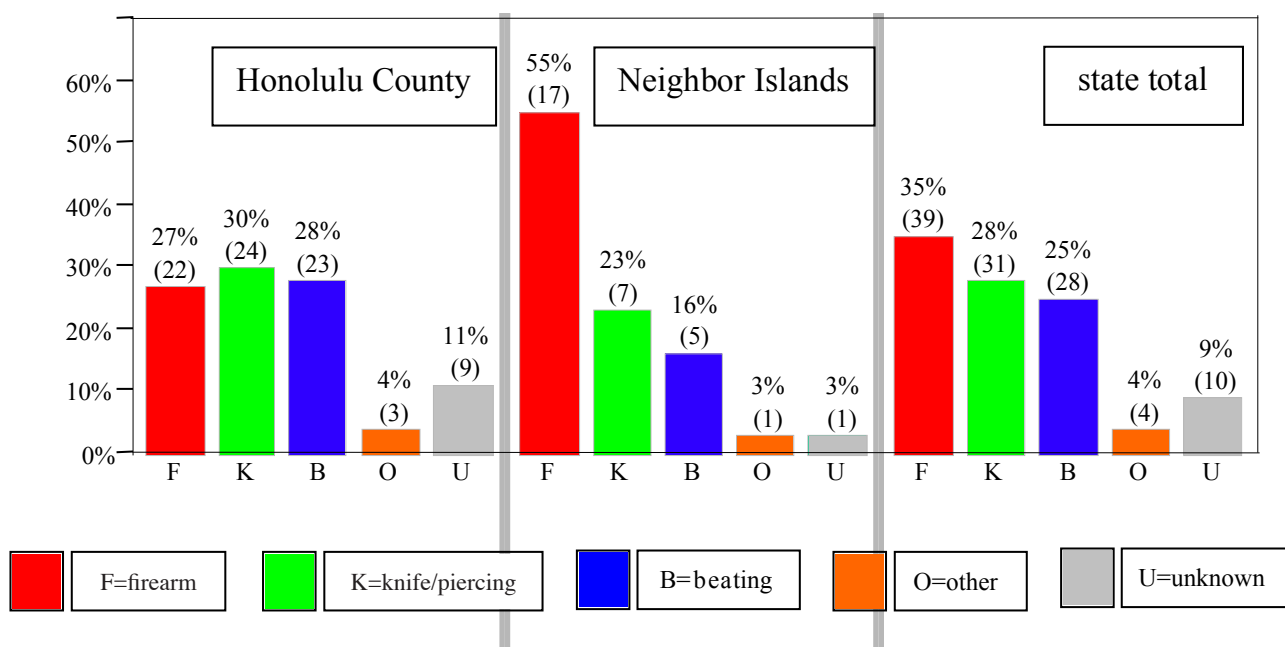
Figure 158 shows the highest 5-year homicide fatality rate was computed for 35 to 44 year-old residents (15 deaths/100,000 residents), significantly higher than the rates for the youngest (under 25 years of age) and oldest (65 years and older) residents. The rates for 25 to 34 year-olds and 45 to 54 year-olds were also significantly higher than the rate for residents under 15 years of age.

Figure 158. Rates (/100,000 residents) of homicide in Hawaii, by age of victim, 2007-2011.



Firearms were the most common means of homicide (35% of victims, followed by stabbings (28%), and physical force or unarmed beatings (25%) (Figure 159). The proportion of murders from firearms was significantly higher among Neighbor Island victims (55%) than residents of Honolulu County (27%). There were no significant differences in mechanism between male and female victims.

Figure 159. Homicides among residents of Hawaii, by mechanism, 2007-2011.



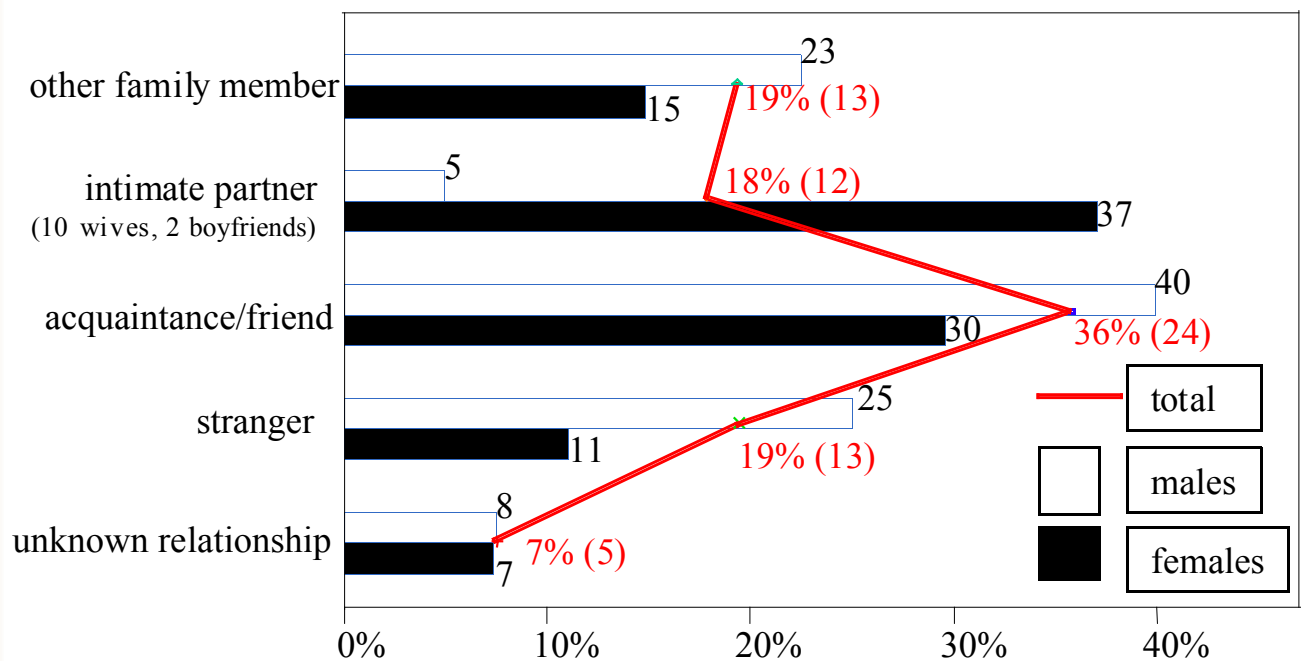
Most (91%, or 67) of the 74 homicides from 2007 to 2009 were linked to Uniform Crime Reports (UCR) to provide additional data on the incident. The following statistics therefore refer only to those 67 deaths that were linked to the UCR data. The proportion of linked records was similar for homicides in Honolulu County (90%), and Neighbor Islands (91%).

According to UCR data, most (73%, or 49) of the 67 victims knew their assailants; only 19% (13) were killed by strangers. (The victim-perpetrator relationship was not known for 5 (7%) of the homicides linked to UCR.) Victims were most commonly killed by someone in their family (37%, or 25) (Figure 160). Family member consisted of roughly equal numbers of intimate partners (12 victims) and “other” family members (13). The 12 intimate partners were mostly (83%, or 10) wives of the perpetrators; there were 2 other victims described as “boyfriends”. “Other” family members included 6 children of the perpetrators,

3 victims killed by in-laws, and 3 others killed by aunts or cousins. All but 1 of the 5 victims who were under 8 years of age were killed by family members. Most (79%, or 19) of the 24 victims were killed by someone they knew outside of their family were killed by an “acquaintance”. Three others were killed by neighbors, 1 by a co-worker, and 1 by a “friend”.

Figure 160 also shows that female victims were more likely to be killed by their intimate partners (37%), than were male victims (5%). Male victims were more likely to be killed by extra-familial acquaintances (40%) or strangers (25%), compared to female victims (26% and 11%, respectively). Victims killed on Neighbor Islands were more likely to have been killed by other family members (40%, vs. 11% for Oahu victims), while Oahu victims were more likely to have been killed by a stranger (26%, vs. 5% for Neighbor Island victims).

Figure 160. Victim-to-assailant relationship for homicides among Hawaii residents, by gender, 2007-2009.



Limited information was available on the circumstances of the murders, as most resulted from “arguments” (40%) or “other” reasons (39%). Five deaths resulted from robberies (including 2 victims who knew their assailants), and 2 from burglaries. Only 1 murder was attributed to the narcotics trade.

Nonfatal injuries

There were no trends in the number of nonfatal injuries from assaults in the state, or within any county (Table 36). Males comprised two-thirds (67%) of the patients treated in EDs and an even greater proportion (89%) of those who were hospitalized. Very few (less than 1%) of the patients under 5 years of age and most (94%) were 15 years or older. More than half (58%) were 15 to 34 years of age. Only 2% were in the senior age range. Honolulu County residents comprised nearly two-thirds (64%) of the patients treated in EDs, and almost three-fourths (72%) of those who were hospitalized.

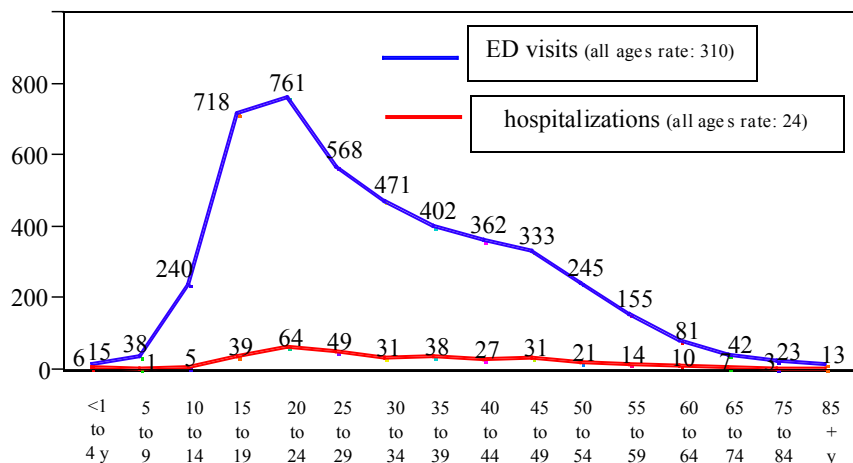
Table 36. Demographic characteristics* of Hawaii residents with nonfatal injuries from assaults.

	ED visits	hospitalizations	total
Year of admission			
2007	4128	321	4449
2008	3985	285	4270
2009	3788	309	4097
2010	3837	311	4148
2011	3943	309	4252
average annual total	3936	307	4243
Patient gender			
Female	1286 (33%)	35 (11%)	1321 (31%)
Male	2651 (67%)	272 (89%)	2923 (69%)
Patient age			
infants	3 (0%)	3 (1%)	6 (0%)
1-4 y	10 (0%)	1 (0%)	11 (0%)
5-14 y	215 (5%)	5 (2%)	220 (5%)
15-24 y	1303 (33%)	92 (30%)	1394 (33%)
25-34 y	974 (25%)	76 (25%)	1050 (25%)
35-44 y	659 (17%)	56 (18%)	715 (17%)
45-54 y	525 (13%)	46 (15%)	572 (13%)
55-64 y	191 (5%)	18 (6%)	209 (5%)
65-74 y	38 (1%)	6 (2%)	44 (1%)
75-84 y	15 (0%)	2 (1%)	17 (0%)
85+ y	4 (0%)	1 (0%)	5 (0%)
County of residence of patient			
Hawaii	743 (19%)	28 (9%)	771 (18%)
Honolulu	2510 (64%)	225 (73%)	2735 (64%)
Kauai	219 (6%)	7 (2%)	226 (5%)
Maui	464 (12%)	47 (15%)	511 (12%)

*Statistics are annual averages over the 2007-2011 period.

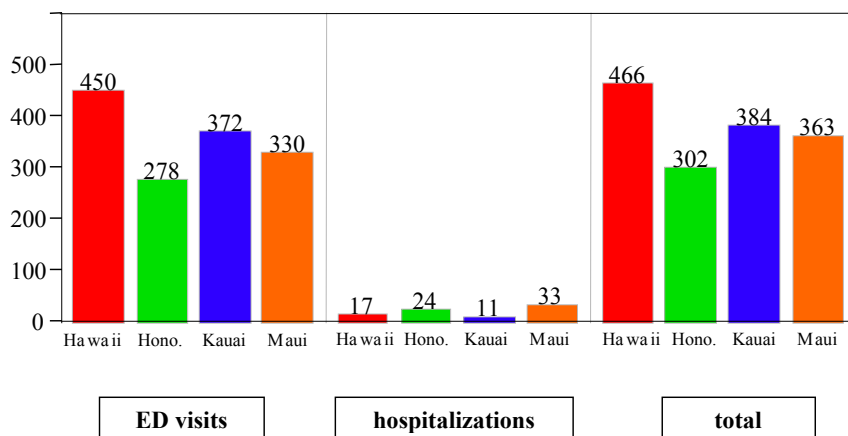
The peak age for rates of both ED visits and hospitalizations was the 15 to 29 year age group, particularly 20 to 24 year-olds (Figure 161). The rates for both types of injuries gradually decreased from this peak over the succeeding age groups. Rates of nonfatal injuries treated in EDs were lowest for the youngest (under 5 years of age) and oldest (75 years and older) residents. Hospitalization rates were slightly elevated among residents under 5 years of age compared to rates for 5 to 14 year-olds (6 vs. 3 hospitalizations/10,000 residents, respectively).

Figure 161. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for nonfatal injuries from assaults in Hawaii, by age of patient, 2007-2011.



The rate for ED visits for residents of Hawaii County was significantly higher than for any other county, while the rate for residents of Honolulu County was significantly lower than any other county (Figure 162). These county differences were also true for all types of injuries (combining both ED visits and hospitalizations). In contrast, the hospitalization rates for residents of Kauai and Hawaii counties were significantly lower than the rates for residents of Honolulu and Maui counties.

Figure 162. Age adjusted annual rates (per 100,000 residents) of nonfatal injuries from assaults, by level of care and county of residence of patient, 2007-2011.



Patients were hospitalized for nearly 5 days on average, with over \$31,000 in charges for each admission (Table 37). Unarmed beatings caused nearly three-quarters (70%) of all injuries, and 61% of those that required hospitalization. Injuries from stabbings (14%) and beatings from blunt objects (11%) were more common among patients who were hospitalized compared to those who were treated in EDs (3% and 8%, respectively). Firearms comprised only a small proportion (2% or less) of either type of injury.

Fractures were the most common type of injury that required hospitalization (53%). Forty-four percent of patients admitted to hospitals had a skull fracture. Internal injuries were also common (28%) among hospitalized patients. Injuries treated in EDs were most commonly contusions or superficial injuries (33%) or open wounds (22%).

Table 37. Clinical characteristics* of Hawaii residents with nonfatal injuries from assaults.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	4.8	1.3
Total number of days	3,936	1,487	5,423
Average charge	\$2,122	\$31,617	\$4,155
Total charges	\$8.4 million	\$9.7 million	\$17.6 million
E-code classifications (mechanism of assault)			
blunt object	299 (8%)	34 (11%)	332 (8%)
firearm	9 (0%)	6 (2%)	15 (0%)
stabbing/piercing	111 (3%)	43 (14%)	154 (4%)
unarmed fight or assault	2775 (71%)	187 (61%)	2962 (70%)
other	199 (5%)	6 (2%)	206 (5%)
unspecified	543 (14%)	30 (10%)	573 (13%)
Primary injury diagnosis			
fractures	602 (15%)	163 (53%)	766 (18%)
fracture of skull	391 (10%)	134 (44%)	525 (12%)
vertebral column	8 (0%)	3 (1%)	11 (0%)
ribs, pelvis or trunk	50 (1%)	5 (2%)	55 (1%)
humerus	5 (0%)	1 (0%)	7 (0%)
lower arm or hand	127 (3%)	7 (2%)	134 (3%)
femur	1 (0%)	4 (1%)	5 (0%)
lower leg or foot	20 (0%)	9 (3%)	29 (1%)
sprains and strains	189 (5%)	1 (0%)	189 (4%)
internal injuries	310 (8%)	85 (28%)	395 (9%)
open wound	875 (22%)	38 (13%)	914 (22%)
contusion/superficial	1286 (33%)	4 (1%)	1290 (30%)
other/unspecified	675 (17%)	15 (5%)	690 (16%)
traumatic brain injury (any priority diagnosis)	1102 (28%)	125 (41%)	1227 (29%)

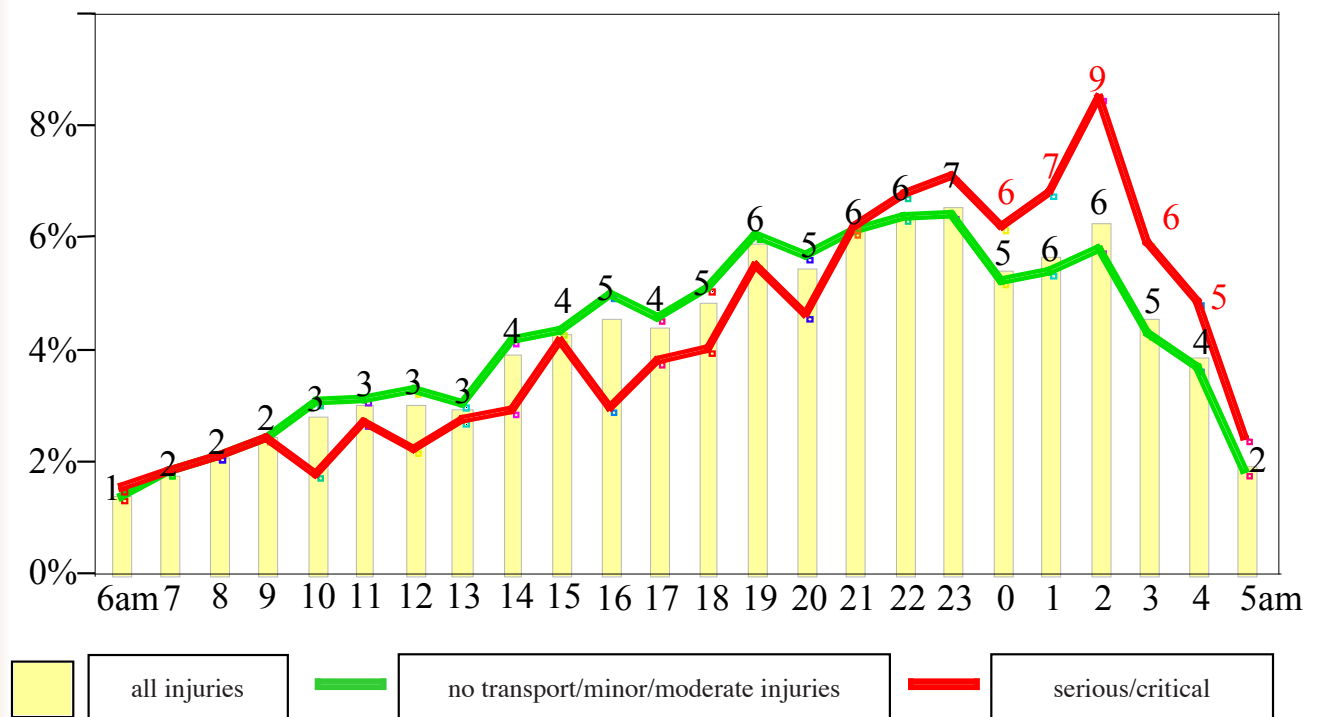
*Statistics are annual averages over the 2007-2011 period.

EMS responded to 13,297 nonfatal injuries from assaults among Hawaii residents over the 2007 to 2011 period. (Excluding records for patients with unknown resident status, those who were transferred to other EMS units (to avoid double-counting of injuries), and 52 patients who were described as dead on arrival.) These injuries resulted from 12,651 separate incidents, as most (96%) involved a single victim.

The number of incidents generally increased over the course of the day (starting at 6 a.m.), reaching a broad peak during the 7:31 p.m. to 2:29 a.m. period (48% of the total) (Figure 163). The time distribution was generally later for patients who were transported in “serious” or “critical” condition, compared to those who were released at the scene or transported with minor or moderate injuries. Almost one-third (32%) of the former types of injuries occurred during the midnight to 4:29 a.m. period, compared to 24% of the less serious injuries. Saturdays (19% of injuries) and Sundays (18%) were the most common days of the week; the rest of the days of the week accounted for 12% to 14% of the injuries. The home or residence of the patient was the most common location for the assault (40%), followed by other indoor location or buildings (17%), most commonly “public buildings” (7%), and bars and restaurants (6%). Another 9% were on streets and roadways. (These statistics include 28% of patients who were assaulted in “other” locations.) About 60% of the victims were males, but males accounted for 74% of patients transported in serious or critical condition. Less than 1% (83) of the patients were under 5 years of age; most (88%) were 18 years or older. The peak age group was from 18 to 30 years (38%, or 5030 patients). This age group accounted for nearly half (46%, or 3176) of the 6980 residents who were assaulted during night time hours.

Figure 163. Time distribution of EMS-attended nonfatal injuries from assaults, by injury severity, 2007-2011.

(Horizontal scale indicates time of EMS dispatch, rounded up to nearest hour (military time scale, starting at 6:00am).
Vertical scale indicates percent of all incidents, rounded to nearest whole number.)



Four of the 5 highest locations for assaults on Oahu were in the metropolitan Honolulu area, from Waikiki to Downtown (Figure 164). There were also high totals in the Waianae, Waipahu, and Wahiawa areas. South Hilo had the highest total among Hawaii County districts, followed by Puna and North Kona (Figure 165). Most (87%) of the assaults on the island of Maui were in the Wailuku (58%) or Lahaina (29%) districts. The Wailuku and Lahaina districts accounted for most (78%) of the crashes on the island of Maui. There were also 68 assaults on the island of Molokai and 25 on Lanai (not shown on the Figure).

Figure 164. Number of EMS-attended assaults on Oahu and eastern Oahu (bottom map), by Neighborhood Board, 2007-2011.

(Percent of all EMS-attended assaults in the state is shown in parentheses.)

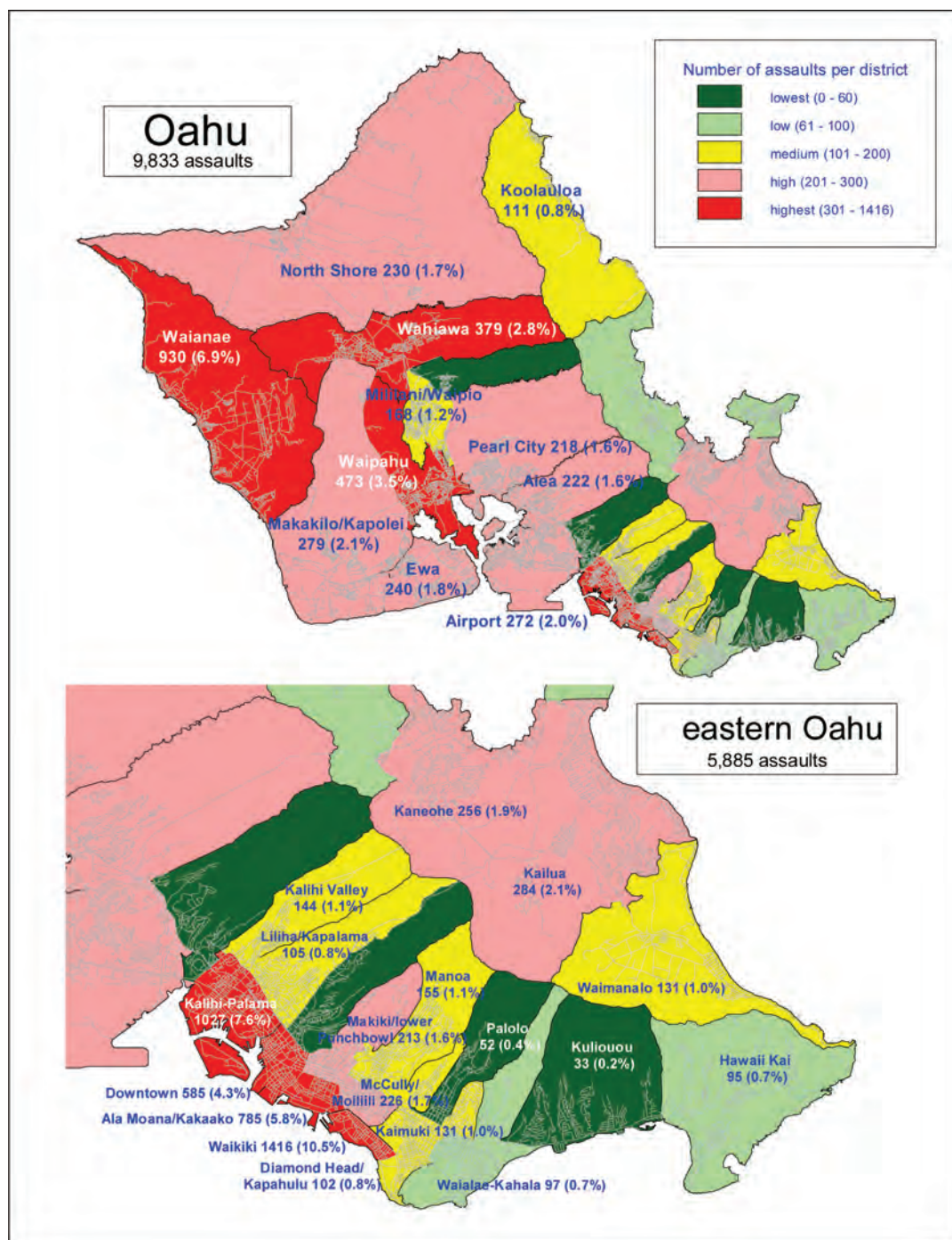
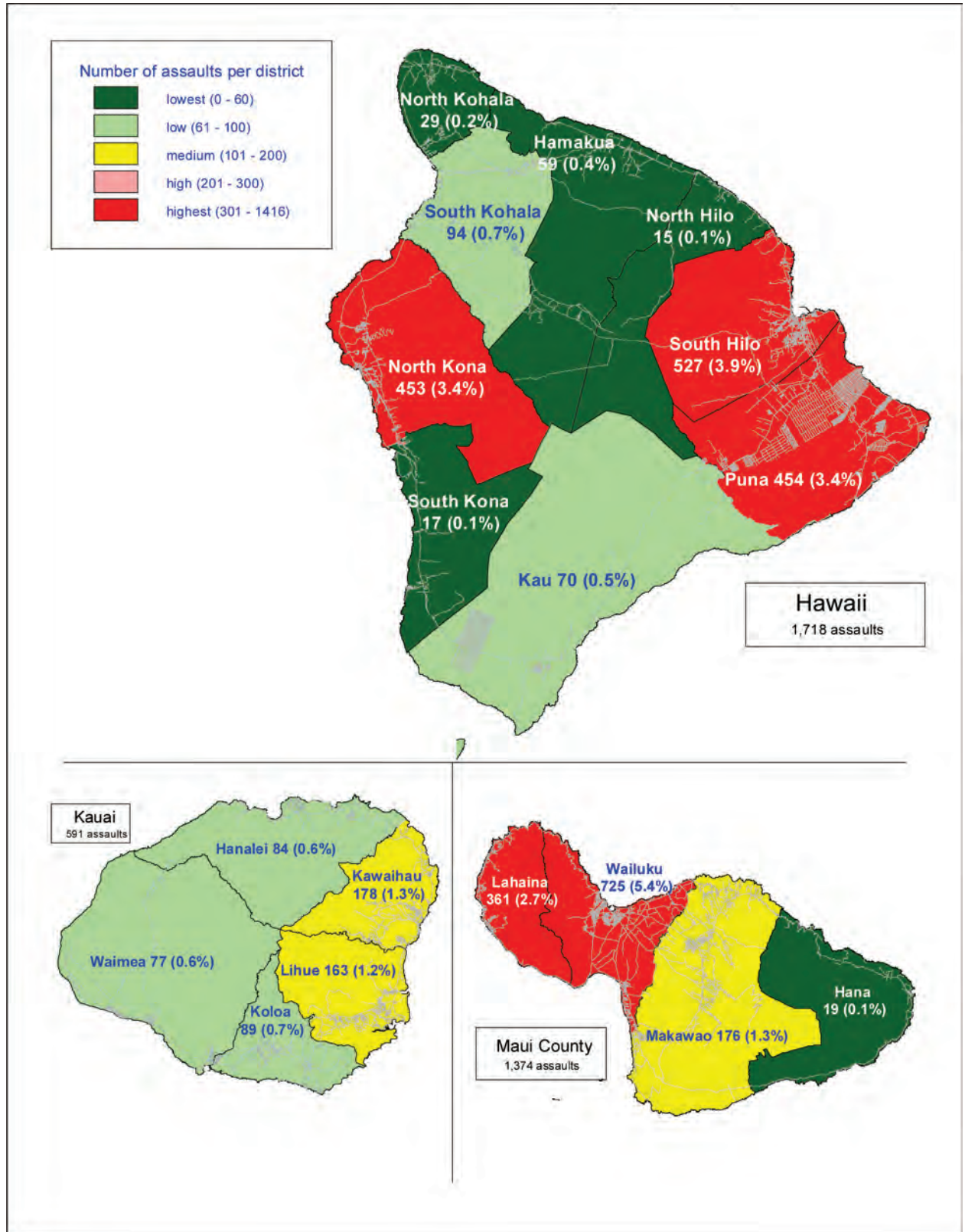


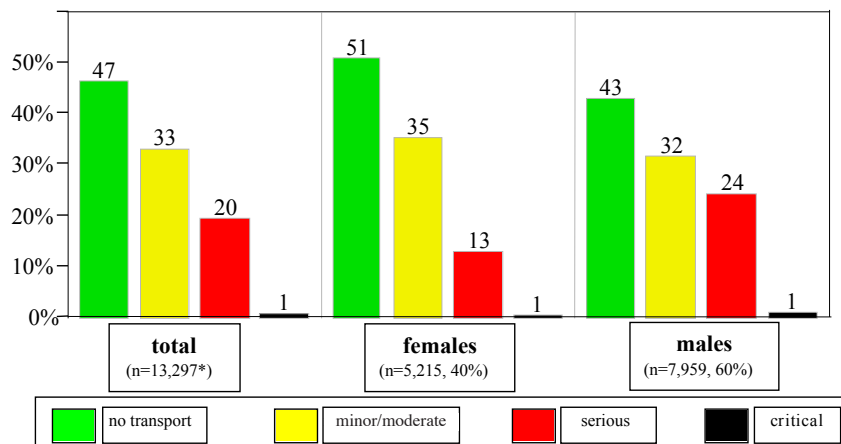
Figure 165. Number of EMS-attended assaults on Neighbor Islands, by district, 2007-2011.

(Percent of all EMS-attended assaults in the state is shown in parentheses.)



About half (47%) of the patients refused EMS transport to hospitals and were released at the scene, although this proportion was significantly lower (43%) among males (Figure 166). Males were significantly more likely to be transported in serious (24%) or critical condition (1.0%), compared to females (13% and 0.6%). Overall, one-fifth (20%) of the injured were transported in serious or critical condition. That proportion was highest among the senior-aged victims (29%), and those who were injured in Kauai (24%) or Hawaii counties (25%).

Figure 166. Distribution of injury severity/transport status of residents treated by EMS personnel for nonfatal injuries from assaults, by gender, 2007-2011.



*Includes 123 patients for whom gender was not recorded.

Probable alcohol use was noted for nearly one-third (29%, or 3901) of the patients (Table 38). This proportion was lowest among patients assaulted on Kauai (15%, vs. 30% for other counties), although the status was unknown for 51% of the Kauai patients (vs. 28% to 33% for the other counties). Average age was comparable between the drinkers and non-drinkers, although the former were more likely to be in the 18 to 30 year age range. The proportion of males among the drinkers was significantly higher than for the other groups. Patients who had consumed alcohol were significantly less likely to be released at the scene, and twice as likely to be transported in serious condition, compared to other patients. The proportion of drinkers who were transported in “critical” condition was significantly higher than that for non-drinkers, but lower than that among whom alcohol status was unknown. Assaults on weekends and during night time hours were also significantly more common among patients who had been drinking than among other patients.

Table 38. Characteristics of patients with EMS-treated nonfatal injuries from assaults, by category of alcohol use, 2007-2011.

	Alcohol use (n=3,901, 29%)	No alcohol use (n=5,035, 38%)	No data/unknown (n=4,361, 33%)
Average age	34 years	34 years	35* years
Ages 18 to 30 years	47%	33%*	36%*
Gender (% male)	75%	53%*	56%*
Disposition			
no transport	34%	52%*	52%*
minor/moderate injuries	35%	33%*	32%*
serious injuries	31%	15%*	15%*
critical injuries	0.8%	0.3%*	1.4%
Weekend assault (Sat/Sunday)	46%	31%*	35%*
Nighttime assault (8 pm - 5 am)	74%	39%*	49%*

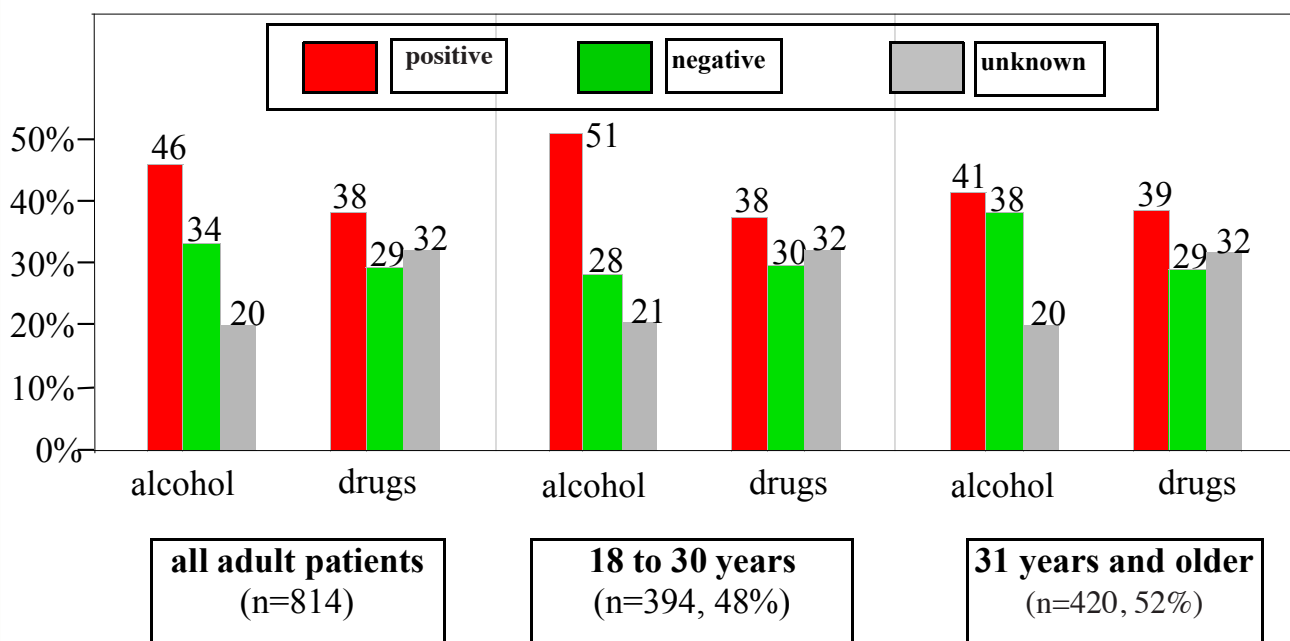
*Indicates statistically significant difference between patients who used alcohol vs. other patients.

Trauma Registry data

Nearly half (46%) of the adult-aged (18 years and older) HTR resident patients who were injured by assaults were positive for alcohol, and more than one-third (38%) tested positive for illicit drugs (Figure 167). Alcohol use was significantly greater among patients in the 18 to 30 year age range (51%), compared to older patients (41%), but there was no difference in drug use between the two groups. About three-fourths (76%, or 286) of the 375 drinkers had BAC levels of 0.08% or greater. THC was the most commonly documented drug (19% of the patients), followed by amphetamines (15%) and narcotics (15%). Amphetamine use was more common among patients 31 years and older (18%), compared to those in the 18 to 30 year age group (11%), while THC was more commonly found among the latter (24%, vs 15% among older patients). Considered together, about two-thirds (67%) of the patients tested positive for either alcohol or drugs.

Alcohol use was significantly more likely among the male patients (49%) compared to females (27%), among those injured on weekends (54% vs. 41% for those assaulted on weekdays), and among those assaulted during night time hours (54%, vs. 30% for those injured between 6:31 a.m. and 7:29 p.m.). Alcohol use was not significantly associated with the mortality rate or the likelihood of a discharge to a rehabilitation facility, either among all patients or within the 2 age groups.

Figure 167. Alcohol and/or drug use (percent) among adult-aged residents treated for assaults in the Hawaii Trauma Registry, by age group, 2008-2011.

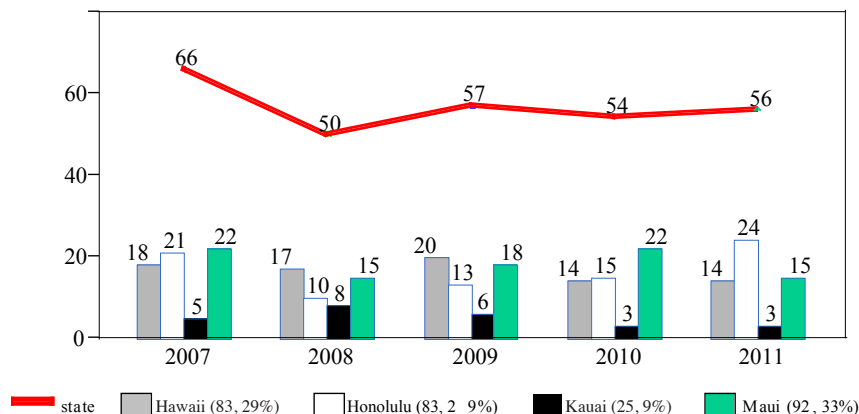


Injuries of Undetermined Intent

Fatal injuries

This is a vague but important category to explore, since there were 283 fatal injuries over the 5-year period for which the intent could not be defined. Figure 168 shows that there was no trend in the annual number of such deaths. The total number was roughly equally divided between deaths that occurred on Hawaii, Honolulu and Maui counties; only about 9% occurred on Kauai. The undetermined intent designation was therefore more likely to be assigned to injury-related deaths that occurred on Neighbor Islands (from 13% for deaths on Kauai County to 20% for Maui County), than for those that occurred on Oahu (4% of all injury-related deaths).

Figure 168. Annual number of fatal injuries of undetermined intent among Hawaii residents, by county, 2007-2011.



The age distribution of these victims (Figure 169) was very similar to that for victims of unintentional poisonings (see Figure 134). There was a peak age of 45 to 54 years (37%, or 107 victims), and nearly three-fourths (73%, or 206) were 35 to 64 years of age. Only 6 (2%) of the victims were under 20 years of age, including 3 who were infants. As for most categories of injuries, male victims (185) far outnumbered female victims (111).

Figure 169. Age and gender distribution of victims of fatal injuries of undetermined intent in Hawaii, 2007-2011.

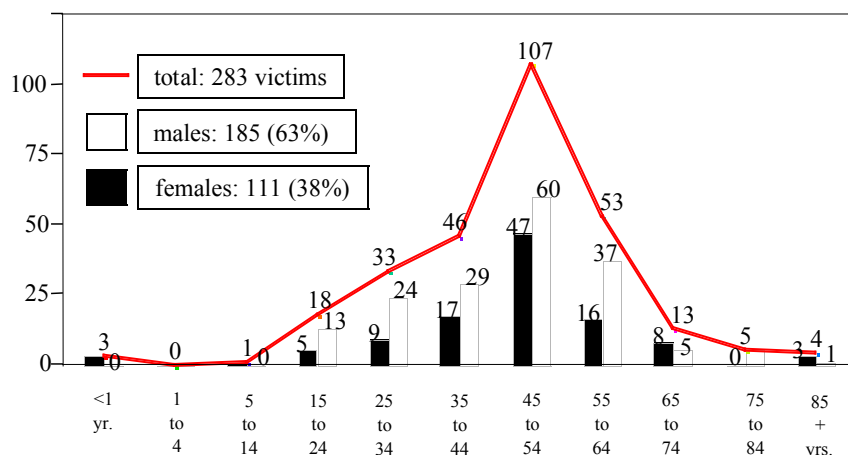
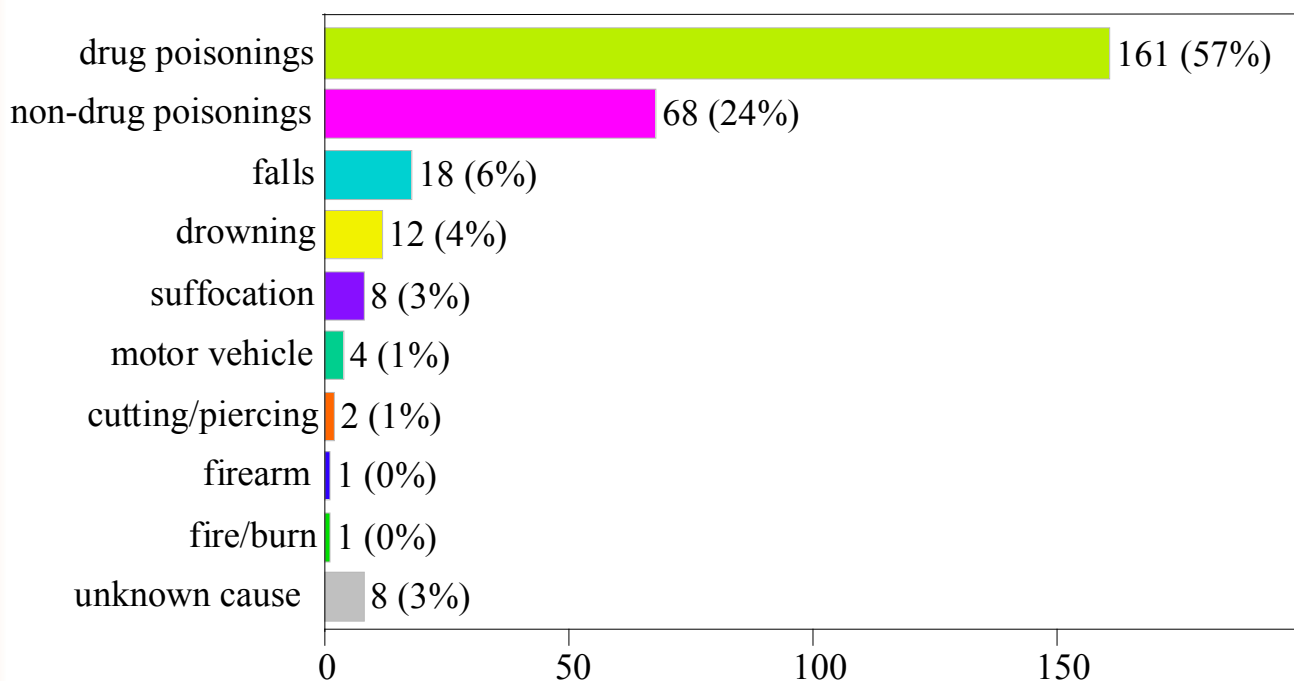


Figure 170 shows that most (81%, or 229) of these fatal injuries were due to poisonings, specifically poisonings due to medicinal substances (57%, or 161). Most (77%, or 177) of the 229 poisonings were among 35 to 64 year-olds, similar to the age distribution of unintentional poisonings (see Figure 134). Less than one-fourth (23%, or 53) of these poisonings occurred on Oahu; there were comparable numbers of deaths on Hawaii (75) and Maui counties (83). In contrast, most (72%, or 13) of the fatal falls occurred on Oahu. The 3 infant fatalities resulted from suffocations.

Figure 170. Fatal injuries of undetermined intent among residents of Hawaii, by injury category, 2007-2011.



Nonfatal injuries

There was an increasing trend annual number of nonfatal injuries of undetermined intent over the 2007 to 2010 period, but a decrease in 2011 (Table 39). Male patients (61% of the total) outnumbered females (39%). Patients in the 15 to 54 year age range comprised the majority of those treated in the ED (72%) and inpatient settings (77%). Oahu residents comprised 69% of the patients treated in EDs, but only about half (55%) of those who were hospitalized.

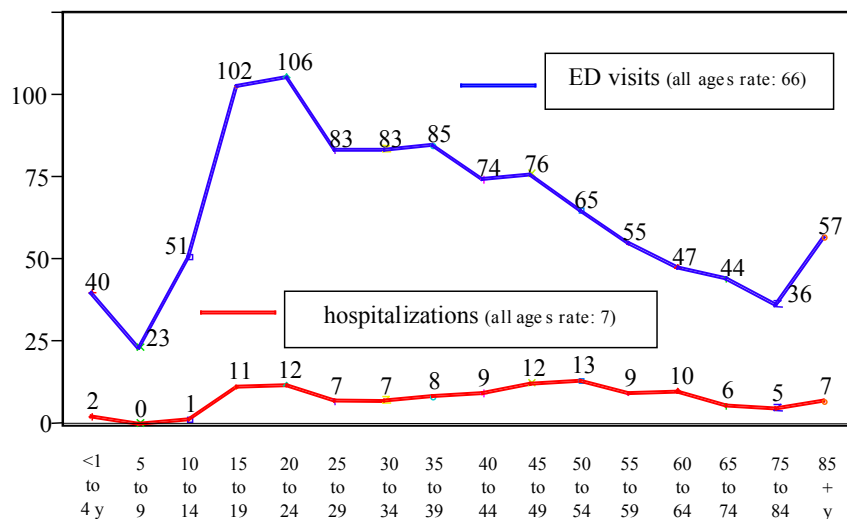
Table 39. Demographic characteristics* of Hawaii residents with nonfatal injuries of undetermined intent.

	ED visits	hospitalizations	total
Year of admission			
2007	504	96	600
2008	664	101	765
2009	1176	83	1259
2010	1221	107	1328
2011	719	105	824
average annual total	857	98	955
Patient gender			
Female	334 (39%)	40 (40%)	374 (39%)
Male	523 (61%)	59 (60%)	581 (61%)
Patient age			
infants	3 (0%)	1 (1%)	5 (1%)
1-4 y	31 (4%)	1 (1%)	32 (3%)
5-14 y	57 (7%)	1 (1%)	58 (6%)
15-24 y	182 (21%)	19 (20%)	201 (21%)
25-34 y	155 (18%)	14 (14%)	169 (18%)
35-44 y	137 (16%)	15 (15%)	152 (16%)
45-54 y	128 (15%)	23 (23%)	151 (16%)
55-64 y	81 (9%)	15 (15%)	96 (10%)
65-74 y	40 (5%)	5 (5%)	45 (5%)
75-84 y	24 (3%)	3 (3%)	27 (3%)
85+ y	17 (2%)	2 (2%)	19 (2%)
County of residence of patient			
Hawaii	71 (8%)	15 (16%)	87 (9%)
Honolulu	592 (69%)	54 (55%)	647 (68%)
Kauai	110 (13%)	12 (12%)	121 (13%)
Maui	83 (10%)	17 (17%)	100 (10%)

*Statistics are annual averages over the 2007-2011 period.

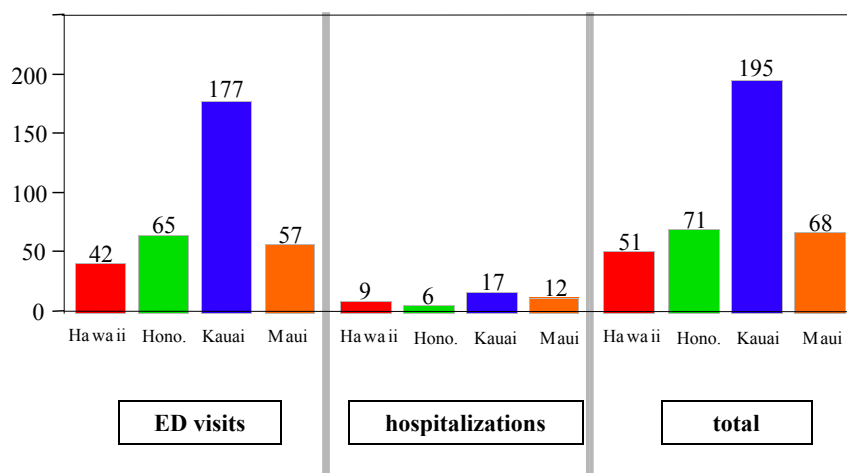
Rates of ED visits were low during childhood until a sharp increase among 15 to 24 year-old residents (Figure 171). Rates remained high over the 15 to 49 year age range before decreasing steadily until increasing among residents 85 years and older. A peak in rates was also seen for hospitalizations among 15 to 24 year-old residents, although there were slightly higher rates among 45 to 54 years-olds.

Figure 171. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for nonfatal injuries of undetermined intent in Hawaii, by age of patient, 2007-2011.



Residents of Kauai County had significantly higher rates of both ED visits and total (ED visits combined with hospitalizations) injuries of undetermined intent, compared to residents of any other county (Figure 172). The ED visit rate for Kauai County residents was 2 to 4 times higher than the rates for residents of other counties. Residents of Hawaii County had the lowest total rates, and the lowest rates of ED visits.

Figure 172. Age adjusted annual rates (per 100,000 residents) of nonfatal injuries of undetermined intent, by level of care and county of residence of patient, 2007-2011.



Patients were hospitalized for 5 days on average, and hospitalizations comprised 36% of the total number of days of care (Table 40). The average charge for a hospitalization was over \$28,000, however, and hospitalizations comprised 74% of the total annual charges of \$3.8 million. The E-codes for most (82%) of the injuries treated in EDs indicated “other” or “unspecified” mechanisms of injury. The most commonly specified type of injury was poisoning (14% of ED visits), specifically from drugs or medicinal substances (12%). More specific E-codes were provided for hospitalizations, over three-fourths (77%) of which were caused by poisonings, usually (74%) from drugs or medicinal substances. The most common types of injuries treated in EDs were sprains and strains (27%), contusions and superficial injuries (20%), and open wounds (16%). Apart from the poisonings, there was a wide distribution of injury types among hospitalized patients, with fractures (10%) being the most common.

Table 40. Clinical characteristics* of Hawaii residents with nonfatal injuries of undetermined intent.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	5.0	1.4
Total number of days	857	490	1347
Average charge	\$1,454	\$28,406	\$3,933
Total charges	\$1.3 million	\$2.8 million	\$3.8 million
Mechanism of injury (E-codes)			
cutting/piercing	16 (2%)	2 (2%)	18 (2%)
falls	10 (1%)	6 (6%)	15 (2%)
firearms	6 (1%)	3 (3%)	9 (1%)
hanging/suffocation	1 (0%)	1 (1%)	2 (0%)
poisoning, drugs/meds	107 (12%)	73 (74%)	180 (19%)
poisoning, other types	18 (2%)	3 (3%)	21 (2%)
other/unspecified means	698 (82%)	11 (12%)	710 (74%)
Primary injury diagnosis			
fractures	96 (11%)	9 (10%)	105 (11%)
sprains and strains	228 (27%)	3 (3%)	231 (24%)
internal injuries	12 (1%)	3 (3%)	15 (2%)
open wounds	135 (16%)	5 (5%)	140 (15%)
contusion/superficial	174 (20%)	0 (0%)	175 (18%)
poisonings	122 (14%)	75 (76%)	197 (21%)
other	89 (10%)	3 (3%)	93 (10%)

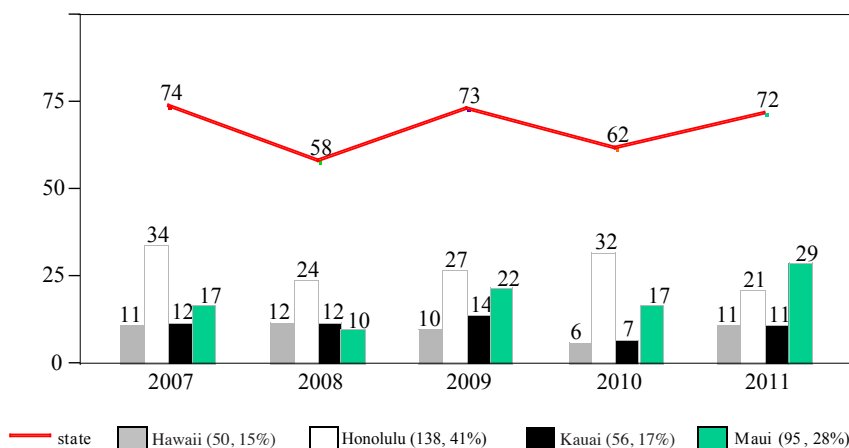
*Statistics are annual averages over the 2007-2011 period.

Injuries Among Non-residents

Fatal injuries

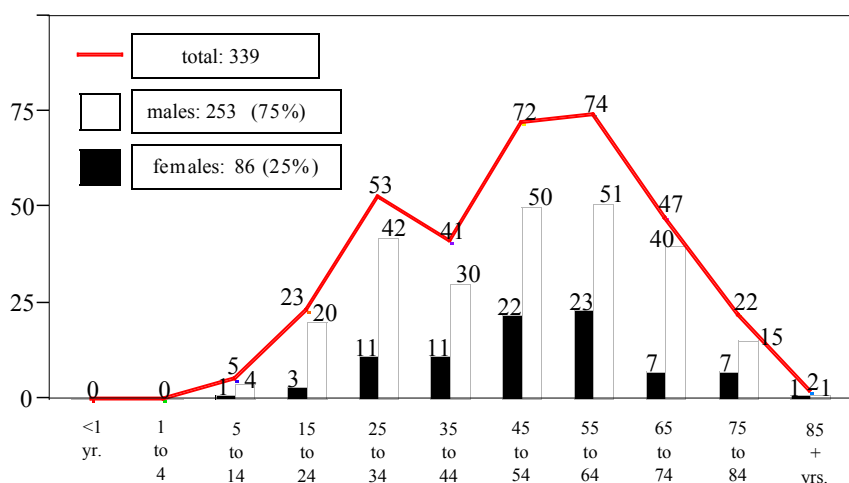
Up to this point, this report has included only information on fatal injuries among Hawaii residents. However, a total of 339 non-residents also died of injuries in Hawaii over the 2007 to 2011 period. There was no clear trend in either the number of non-resident deaths and the number of incidents that caused the fatalities (Figure 173). The 339 deaths were caused by 330 incidents. Four non-residents died in a helicopter crash on Molokai in 2011, 3 in a helicopter crash on Kauai in 2007, and 3 in a car crash on Maui in 2007. There were 138 deaths on Oahu, 95 in Maui County, and nearly equal numbers in Kauai (56 deaths) and Hawaii (50) counties. There were no apparent trends within counties. More than three-fourths (78%, or 263) of the victims were residents of other U.S. states, and the remaining 23% (76) were residents of foreign countries. Among the foreign residents, Japanese was the most common ethnicity listed on the death certificates (32 victims, or 42% of the total). (Note that only information on victim ethnicity was available, not country of residence.)

Figure 173. Annual number of fatal injuries among non-residents in Hawaii, by county, 2007-2011.



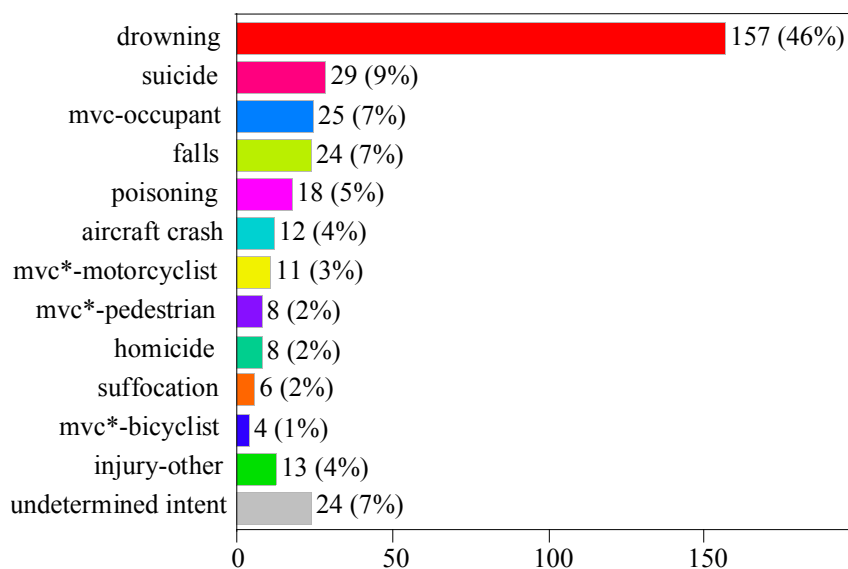
Almost half (43%, or 146) of the victims were between the ages of 45 and 64 years old, and most (85%, or 287) were 25 to 74 years of age. In general, the age distribution of the non-resident victims was similar to that among resident victims, except there were proportionally fewer older victims (ages 75 and older) among the former (7% vs. 21%, respectively), and more victims in the 55 to 74 year age range (36% vs. 20%, respectively). Three-fourths (75%, or 253) of the non-resident victims were males, similar to the proportion for resident victims of fatal injuries (71%).

Figure 174. Age and gender distribution of non-resident victims of fatal injuries in Hawaii, 2007-2011.



Most (82%, or 277) of the deaths were due to unintentional injuries. Drowning was by far the leading cause, accounting for nearly half (46%, or 157) of all deaths, and more than all other unintentional causes combined (Figure 175). This proportion was highest for non-resident deaths in Kauai (61%), and Maui (53%) counties. Most (87%, or 136) of the drownings occurred in the ocean, 10 in streams or freshwater environments, and 9 in hotel swimming pools. Non-resident drownings are discussed in more detail in the following chapter. The 2nd leading cause was suicide, with most (69%, or 20) of the 29 deaths occurring on Oahu. Motor vehicle crashes accounted for 14% (47) of the deaths, including 25 deaths among car occupants. According to FARS records from 2007 to 2010, 40% (8 of 20) of the fatally injured occupants were not wearing seat belts at the time of the crash. Only half (12) of the 24 victims of fatal falls were 65 years of age and older; this proportion was much higher (79%) among Hawaii residents who were killed by falls. All but 1 of the 18 poisonings were due to drugs, including 12 from narcotics and psychodysleptics. Twelve victims died from 6 separate aircraft crashes, including 8 who died in 3 helicopter crashes. Six of the 11 motorcyclists were killed in 2011. Among the 5 motorcyclists killed from 2007 to 2010, only 1 was wearing a helmet, according to FARS records. About half (46%, or 11) of the 24 deaths of undetermined intent were due to drug poisonings, 7 (29%) from drownings, and 4 (17%) from falls.

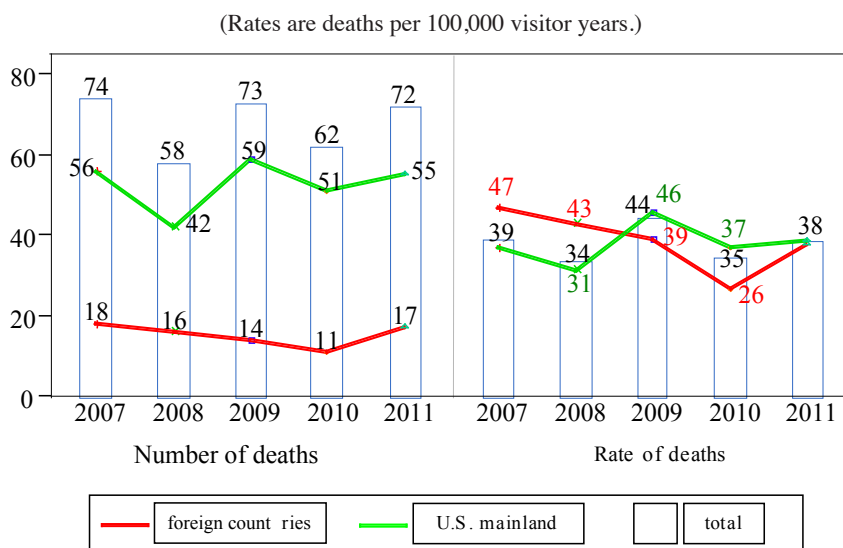
Figure 175. Fatal injuries among non-residents of Hawaii, by injury category, 2007-2011.



*mvc = motor vehicle crash

There was no clear trend in the number or rate of non-residents killed by injuries (Figure 176). However, there was a consistent decrease in the deaths of non-residents from foreign countries, from 2007 (18 deaths) to 2010 (11 deaths), before an increase in 2011 (17 deaths). Annual fatality rates followed the same pattern as the number of deaths, suggesting there was no change in the risk of fatal injuries among non-residents over this 5-year period. The estimated fatality rates among non-residents from foreign countries were statistically comparable to those for residents of other States for all years and for the 5-year period as a whole.

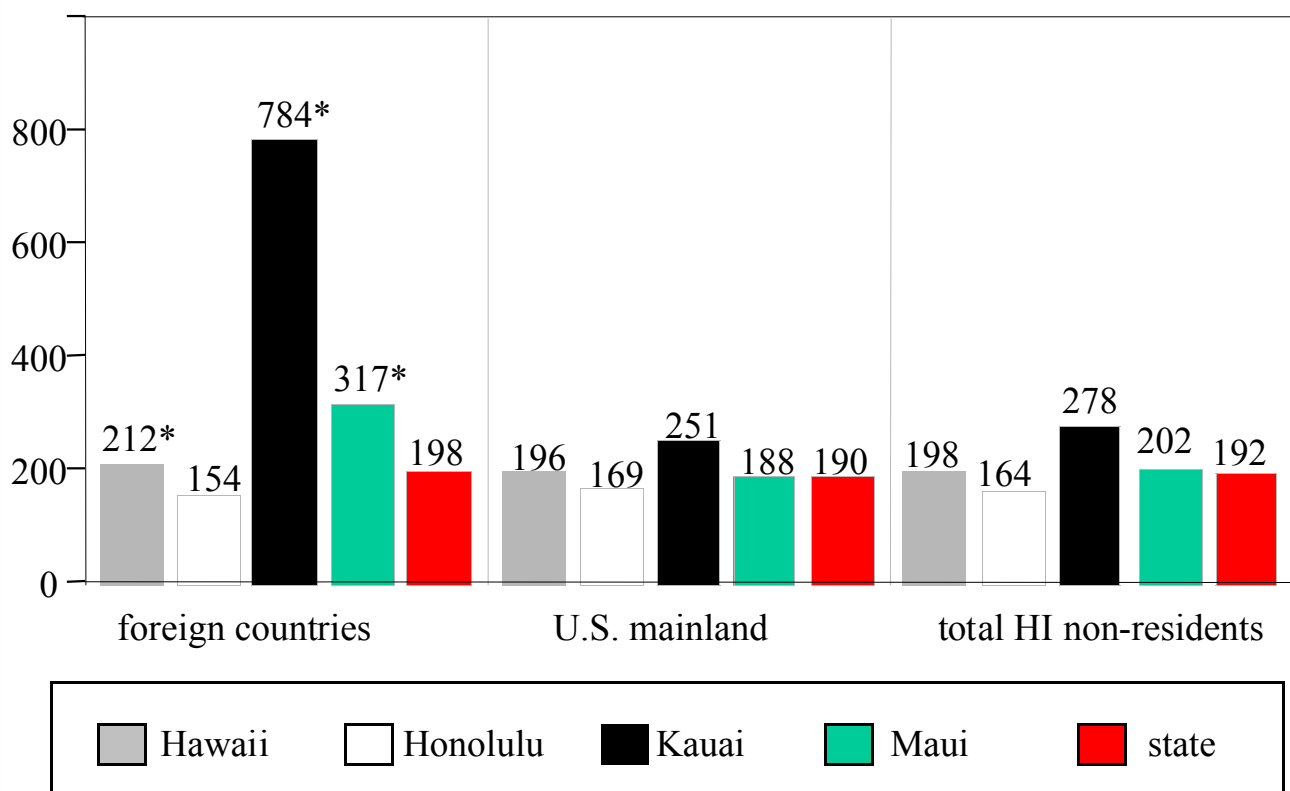
Figure 176. Annual number and rate of fatal injuries among non-residents in Hawaii, by nation of origin, 2007-2011.



Kauai had the highest unintentional injury fatality rates among visitors, particularly among visitors from foreign countries (Figure 177). The fatality rate for foreigners on Kauai was significantly higher than the rates for Honolulu and Hawaii counties. Fatality rates among residents of other United States were statistically comparable across counties, with the exception of a higher rate for Kauai compared to Honolulu. A similar pattern was seen when the total fatality rates (residents of foreign countries combined with residents of other States) were compared. (Note that the rate estimates were based on fewer than 20 deaths for each of the Neighbor Islands and are therefore unreliable estimates.)

Figure 177. Five-year rates of fatal injuries among non-residents of Hawaii, by county of injury, 2007-2011.

(Rate are deaths per 100,000 visitor years.)



*Rate is based on fewer than 20 deaths and should be interpreted with caution.

Nonfatal injuries

Most (85%) of the patients were residents of other U.S. states, and 15% were residents of foreign countries. The number of non-residents who were treated in EDs for nonfatal injuries generally increased over the 2008 through 2011 period, while the trend was less clear regarding the annual number of hospitalizations (Table 41). (Note that these totals include all injuries, whether e-coded or not.) Patient gender was equally distributed overall, although males comprised a slight majority (52%) of those who were hospitalized. Patients treated in EDs were significantly younger than those who were admitted to hospitals (mean age: 41 vs. 51 years, respectively). Age was widely distributed for both types of patients, however. (It was not possible to look at age-specific rate estimates since the age distribution of non-residents is not known.)

Table 41. Demographic characteristics* of non-residents with nonfatal injuries.

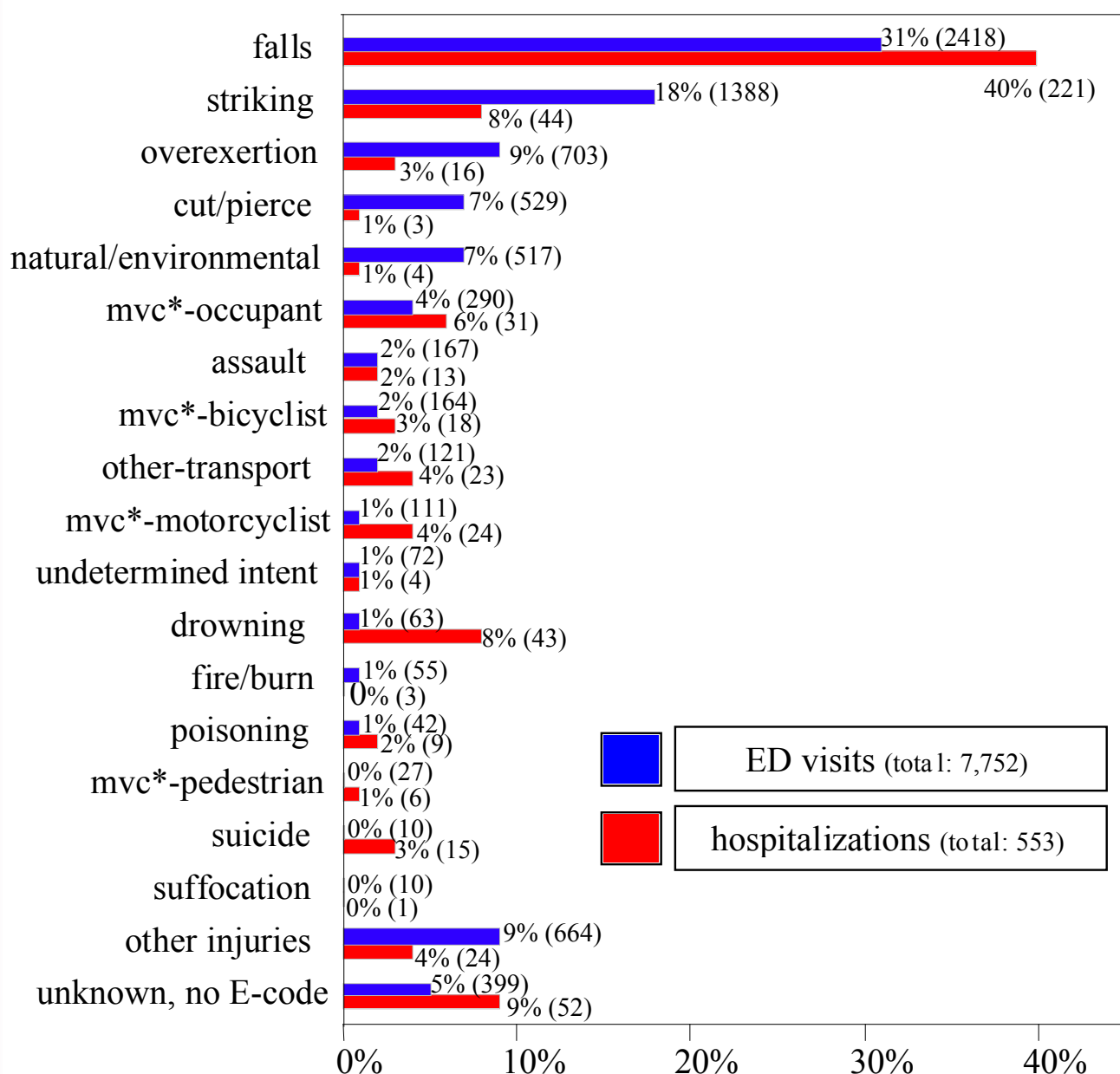
	ED visits	hospitalizations	total
Year of admission			
2007	8726	624	9350
2008	7088	504	7592
2009	7327	497	7824
2010	7534	577	8111
2011	8084	564	8648
average annual total	7752	553	8305
Patient gender			
Female	3884 (50%)	265 (48%)	4150 (50%)
Male	3867 (50%)	288 (52%)	4155 (50%)
Patient age			
infants	49 (1%)	3 (0%)	51 (1%)
1-4 y	371 (5%)	12 (2%)	384 (5%)
5-14 y	582 (8%)	16 (3%)	598 (7%)
15-24 y	1074 (14%)	57 (10%)	1131 (14%)
25-34 y	1158 (15%)	67 (12%)	1225 (15%)
35-44 y	1043 (13%)	52 (9%)	1095 (13%)
45-54 y	1199 (15%)	74 (13%)	1273 (15%)
55-64 y	1136 (15%)	93 (17%)	1229 (15%)
65-74 y	662 (9%)	78 (14%)	741 (9%)
75-84 y	367 (5%)	70 (13%)	437 (5%)
85+ y	111 (1%)	31 (6%)	142 (2%)

*Statistics are annual averages over the 2007-2011 period.

Falls were by far the leading cause of nonfatal injuries among non-residents who were treated in EDs (31% of patients) or who were hospitalized (40%) (Figure 178). Injuries from being struck by falling objects or by persons were the 2nd leading cause of both ED visits (18%) and hospitalizations (8%). Otherwise, the main causes of injury were different between the two types of patients. Near drownings (8%), and car crashes (6%) were the next most common causes of injuries requiring hospitalization, while injuries from overexertion (9%), cutting and piercing injuries (7%) and injuries from natural or environmental factors (7%) were more common among patients treated in EDs.

Figure 178. Causes of nonfatal unintentional injuries among non-residents in Hawaii, by level of medical care, 2007-2011.

(Percent of injuries by cause, annual number listed in parenthesis.)



*mvc = motor vehicle crash

Medical charges for nonfatal injuries among non-residents totaled nearly \$30 million each year (Table 42). Hospitalizations accounted for most (62%) of that total, with an average of nearly \$33,000 in medical charges per hospitalization. Over half (60%) of the hospitalized patients had a fracture, with a wide distribution in the anatomical locations of the fractures. Internal injuries were also relatively common (14%) among hospitalized patients. Open wounds (28%), contusions and superficial injuries (19%), sprains and strains (16%) and fractures (18%) were the most common types of injuries among non-residents who were treated in EDs. The incidence of TBI was twice as high among hospitalized patients (17%), compared to those discharged from the ED (8%).

Table 42. Clinical characteristics* of non-residents with nonfatal injuries.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	5.1	1.3
Total number of days	7,752	2,813	10,564
Average charge	\$1,449	\$32,917	\$3,320
Total charges	\$11.2 million	\$18.2 million	\$29.5 million
Primary injury diagnosis			
fractures	1378 (18%)	330 (60%)	1708 (21%)
fracture of skull	90 (1%)	36 (6%)	126 (2%)
vertebral column	55 (1%)	49 (9%)	104 (1%)
ribs, pelvis or trunk	171 (2%)	32 (6%)	203 (2%)
humerus	112 (1%)	20 (4%)	132 (2%)
lower arm or hand	455 (6%)	24 (4%)	479 (6%)
femur	9 (0%)	90 (16%)	100 (1%)
lower leg or foot	486 (6%)	79 (14%)	565 (7%)
dislocations	300 (4%)	7 (1%)	306 (4%)
sprains and strains	1244 (16%)	10 (2%)	1253 (15%)
internal injuries	200 (3%)	79 (14%)	279 (3%)
open wound	2166 (28%)	18 (3%)	2184 (26%)
contusion/superficial	1490 (19%)	8 (1%)	1497 (18%)
other/unspecified	974 (13%)	102 (18%)	1076 (13%)
traumatic brain injury (any priority diagnosis)	593 (8%)	92 (17%)	685 (8%)

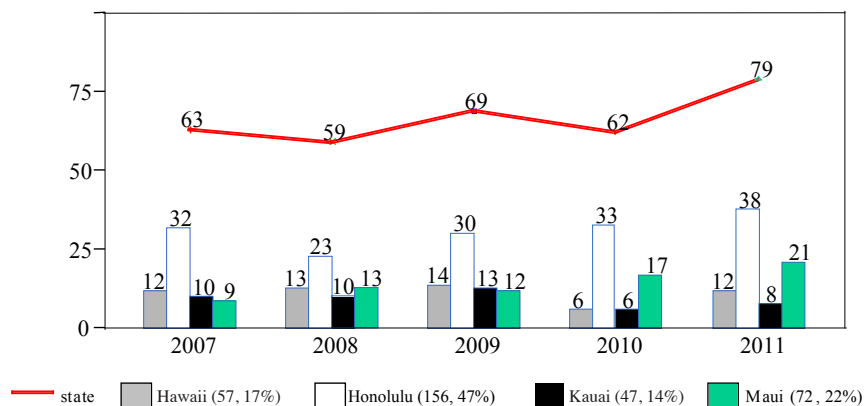
*Statistics are annual averages over the 2007-2011 period.

Drownings and Near Drownings (Residents and Non-residents)

Fatal injuries

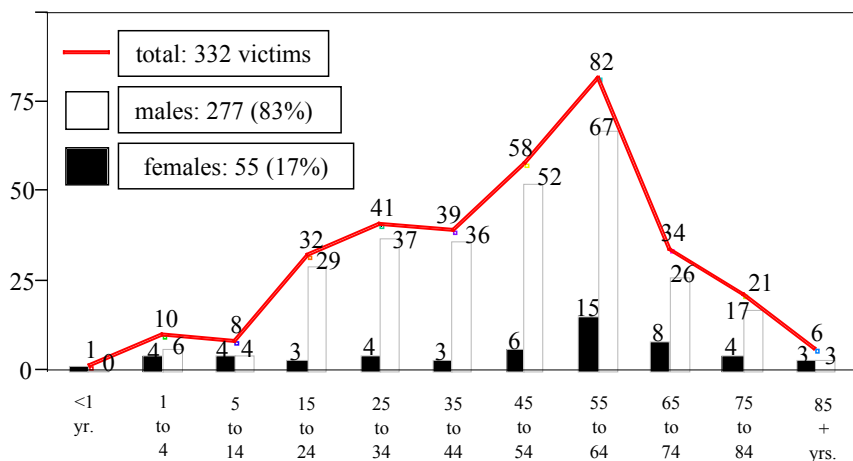
The previous chapter on drownings included only information on victims who were residents of Hawaii; this chapter also incorporates information from drownings among non-residents. There were 332 drownings over the 5-year period, with by far the highest total (79) in 2011 (Figure 179). The 79 deaths in 2011 was the highest total since at least 1993, surpassing the 2005 total of 77 drownings. Figure 179 also shows most of the high total in 2011 was due to drownings on Honolulu and Maui counties. There were 67 drownings on the island of Maui, 3 on Molokai, and 2 on the island of Lanai. The 332 drownings included 175 (53%) Hawaii residents, and 157 (47%) non-residents. Most of the non-residents (75%, or 118) were from other U.S. states, with the remaining 39 victims residing in foreign countries.

Figure 179. Annual number of drownings (including non-residents) in Hawaii, by county, 2007-2011.



Drownings occurred among victims of all ages, with a large peak of victims in the 45 to 64 year age range (42%, or 140 of the victims) (Figure 180). Non-resident victims were significantly older, on average, than resident victims (53 vs. 43 years of age), with proportionally more 55 to 74 year-old victims among the former (48% vs. 30% among resident victims). Only 55 of the victims (17%) were females; males outnumbered females by a 5-to-1 ratio. That gender ratio was closer among the very young and very old victims.

Figure 180. Age and gender distribution of drowning victims (including non-residents) in Hawaii, 2007-2011.

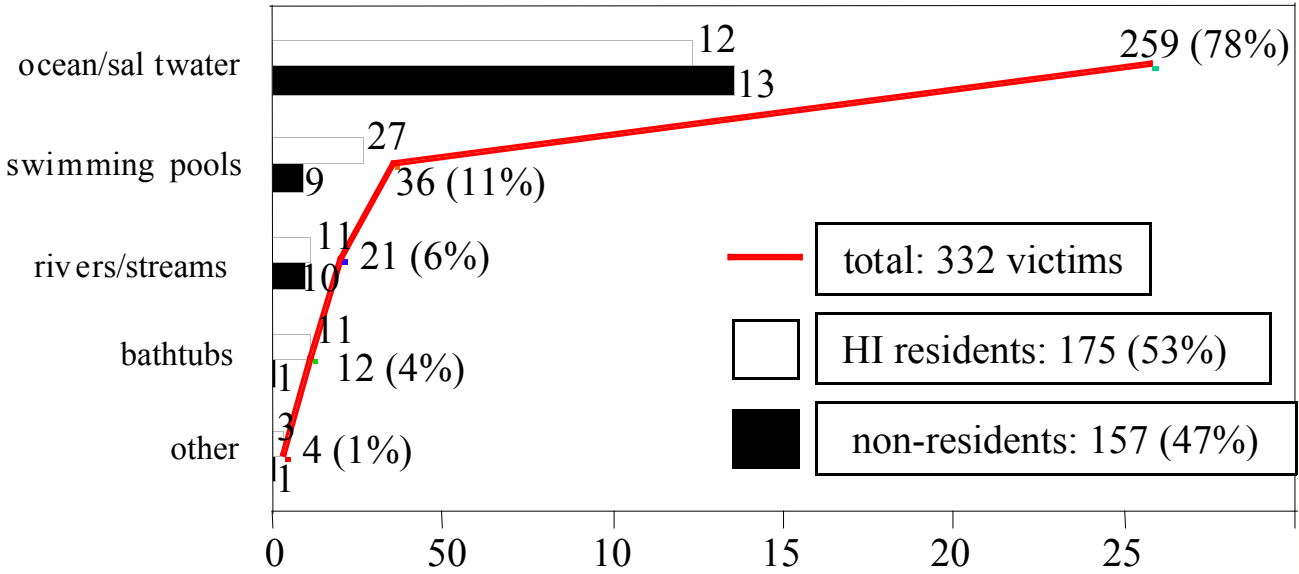


Overall, 78% (259) of the drownings occurred in the ocean or other saltwater environments (Figure 181), although that proportion was significantly higher for non-resident victims (87%), compared to residents (70%). Drownings in swimming pools (11%, or 36), and rivers and other freshwater bodies (6%, or 21) made up most of the remaining drownings. There were also 12 victims who drowned in bathtubs and 4 in “other” environments.

Only 3 (8%) of the 36 victims who drowned in swimming pools were under 5 years of age, as victim age was widely distributed in this environment. There were at least 2 such deaths in each county, although most (75%, or 27) occurred on Oahu. Nine of these 36 drownings occurred at single family homes, 13 in apartment buildings/condominiums, 11 in hotel pools, and the remaining 3 at community pools.

Almost all the 21 freshwater drowning victims were young to middle-aged adults; 18 (86%) were 20 to 53 years of age. These deaths were widely dispersed geographically with county totals varying between 3 to 7 deaths. However, there were 4 drownings in Kipu Falls on Kauai, 1 each year from 2008 to 2011. All 7 of the freshwater drownings in Hawaii County were in the Hilo area, between the Wailuku River (4 drownings) and Papaikou. The 12 victims who drowned in bathtubs included 4 (33%) who were under 4 years of age (all of whom were Hawaii residents), and 6 (50%) who were 57 years or older. All but 1 of the older victims drowned on Oahu. (The saltwater drownings will be discussed in more detail, including data that was linked to Honolulu County autopsy records from 2007 to 2010.)

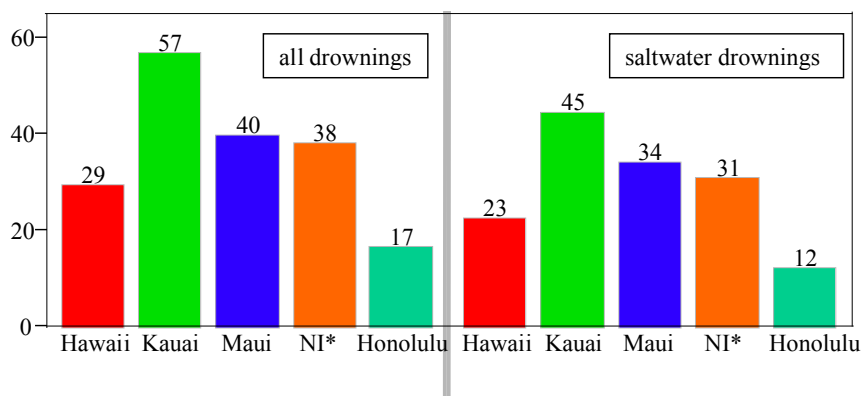
Figure 181. Drownings in Hawaii, by environment and residency, 2007-2011.



Drowning rates were significantly lower for Honolulu County compared to any other county, for all drownings as well as for those that occurred in saltwater environments (Figure 182). The highest rates were computed for Kauai, approximately twice as high as rates for Hawaii County and more than 3 times the rates for Honolulu County. Rates for Hawaii County were intermediate, significantly lower than the rates for Maui (saltwater drownings only) and Kauai counties (either type of drowning). If all the Neighbor Islands are considered together, the rates of drownings (both total and saltwater) are significantly higher than the rates for Honolulu County.

Figure 182. Rate for all types of drownings (left side) and for saltwater drownings (right side) in Hawaii, by county of injury, 2007-2011.

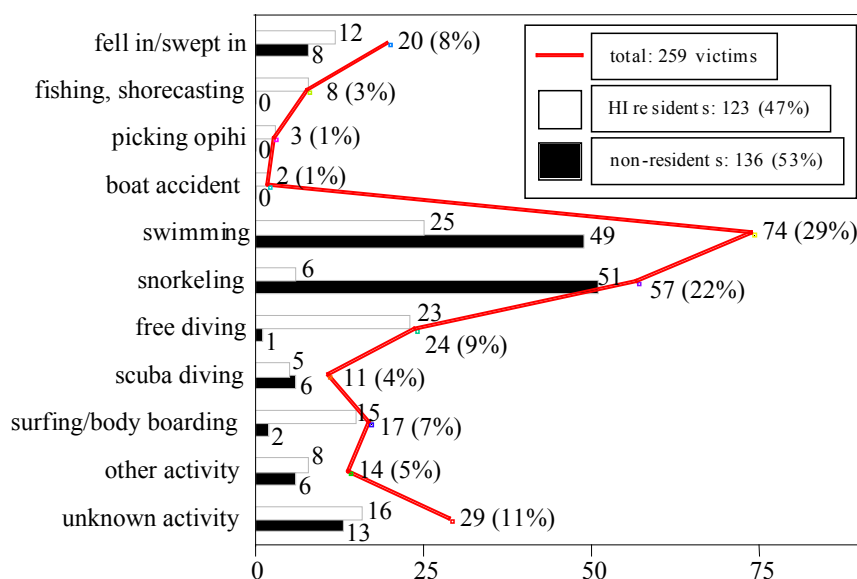
(Rate is per 100,000 de facto population. Crude rates are shown, unadjusted for age distribution.)



*N.I.=Neighbor Islands (combined totals for Hawaii, Kauai, and Maui counties.)

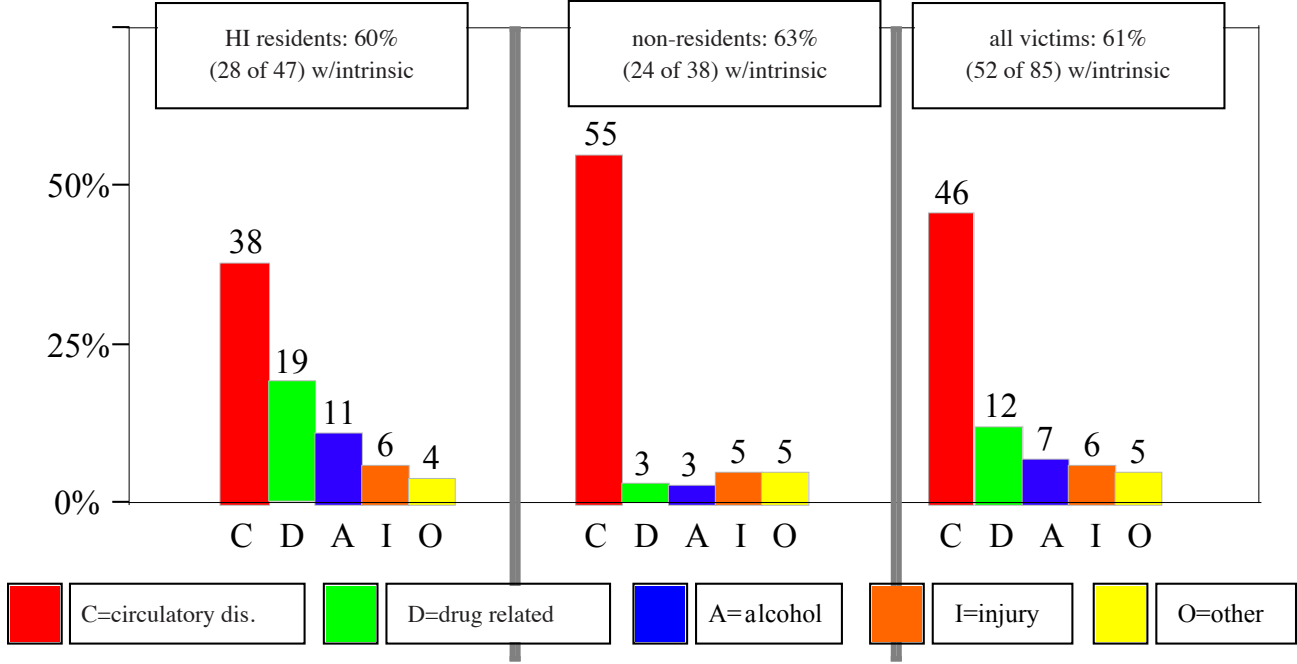
The most common activity among the 259 victims of saltwater drownings was swimming, accounting for almost one quarter (74, or 29%) of the total (Figure 183). Most of these victims (66%, or 49) were non-residents. Snorkeling was the next most common activity (22%, or 57 victims) overall, and the most common activity among non-residents who drowned (51 victims, or 38% of the 136 total non-resident victims). There were 33 drownings resulting from unintentional immersions including people who fell in or were swept in (20), fishing (8) or gathering (3) from shore, or who drowned after boat accidents (2). Most (76%, or 25) of those 33 victims were residents. All but 1 of the 24 victims who were free diving were residents, while there were nearly equal numbers of residents (5) and non-residents (6) among those who were scuba diving. Activity could not be determined for 11% (29) of the victims.

Figure 183. Ocean drownings in Hawaii, by activity and residency of victim, 2007-2011.



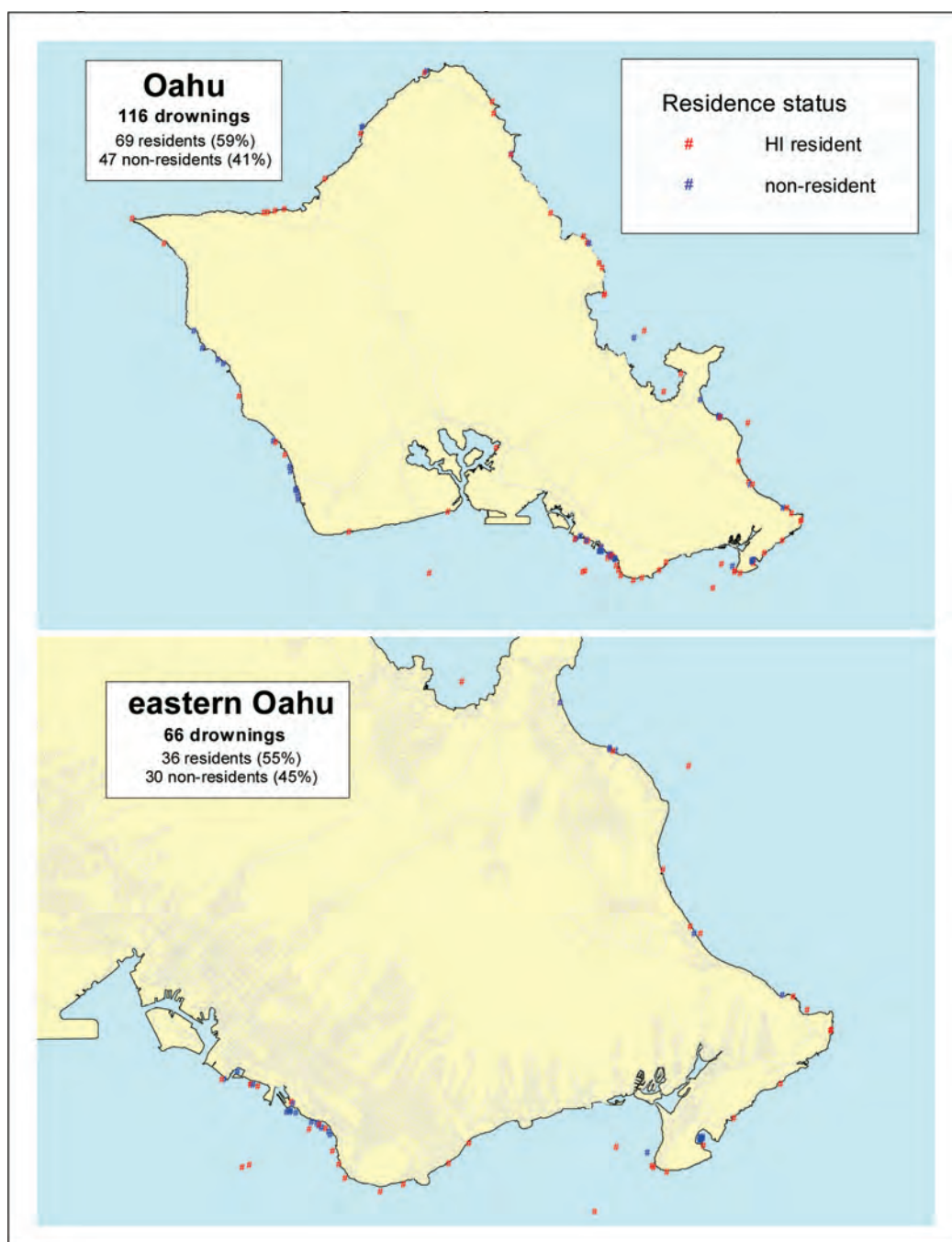
Autopsy records were reviewed for all but 1 of the 86 saltwater drownings in Honolulu County over the 2007 to 2010 period. More than half (61%, or 52) of the 85 ocean drownings were at least somewhat related to intrinsic or personal factors among victims (Figure 184). Intrinsic or personal factors were significantly equally common among resident victims (60%) and non-residents (63%). However, non-resident victims were more likely to have had contributing circulatory diseases (55%, vs. 38% for residents), while drownings among residents were more likely to have been drug- or alcohol-related. Circulatory diseases were the most common type of intrinsic factor, contributing to nearly one-half (46%) of the drownings. Circulatory diseases were documented for most (69%, or 35 of 51) of victims aged 50 and older, and all 16 of the senior-aged victims.

Figure 184. Prevalence of intrinsic factors in saltwater drownings on Oahu, by residence of victims, 2007-2010.



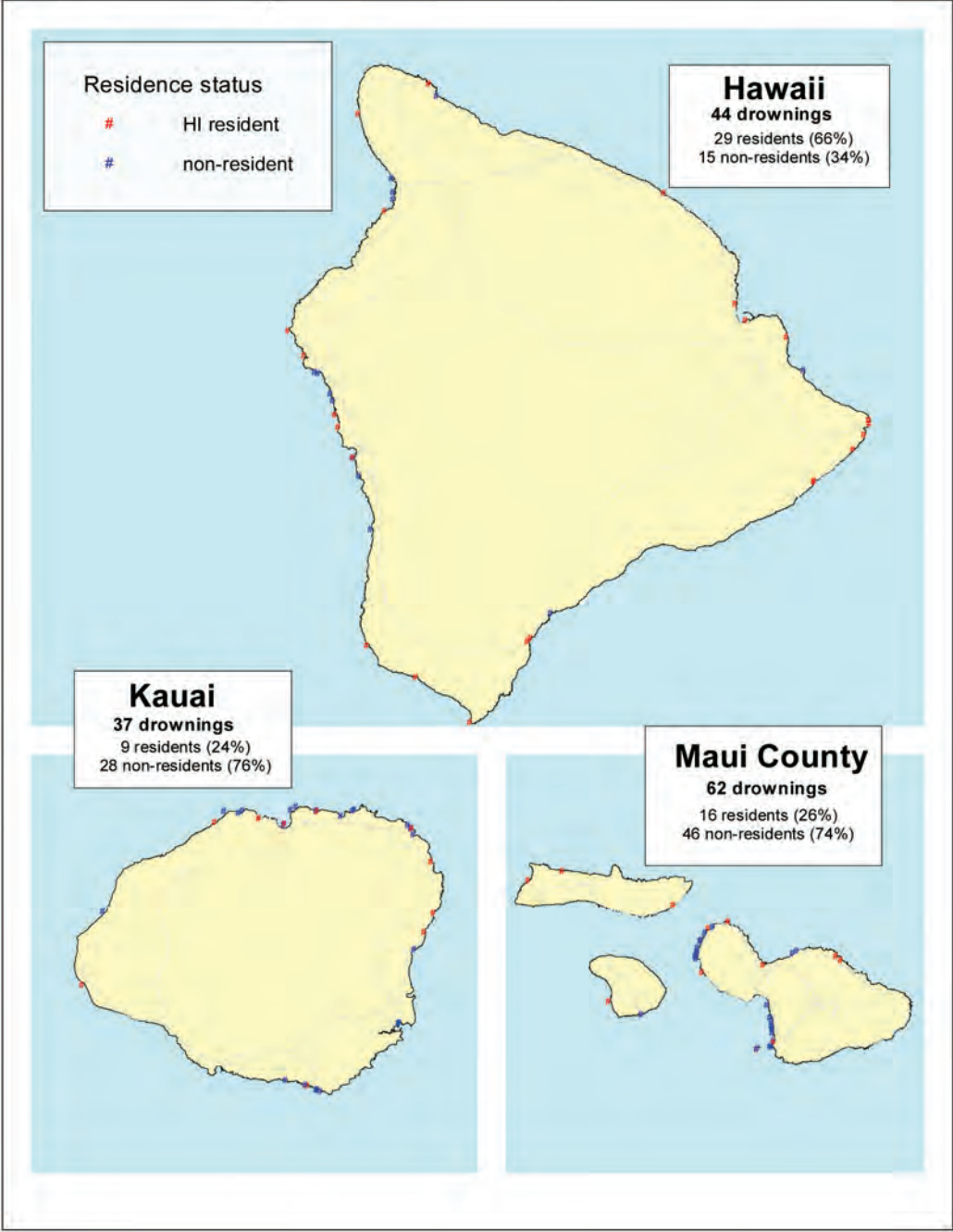
Resident (69 victims) outnumbered non-residents (47 victims) among the 116 ocean drowning victims on Oahu from 2007-2011 (Figure 185). More than half (57%, or 66) of these drownings occurred on the eastern part of the island, from Sand Island, around Hanauma and Makapuu to Kailua Bay. There were 8 drownings from Kewalo Basin to the Ala Wai Yacht Harbor, including 4 at Ala Moana Beach Park. Five of these victims were residents. In contrast, non-resident comprised most (67%, or 12) of the 18 drowning victims in Waikiki (from Hilton Village to Kapahulu Ave.). All but 1 of the 9 drownings in Hanauma Bay were among non-residents, including 5 among residents of foreign countries, and 3 from other U.S. states. There were also 6 drownings (including 5 residents) on the eastern end of the island from the Makai Pier to Makapuu Head. There were 19 drownings along the length of the Waianae Coast, including 5 between Makaha and Pokai Bay Beach Parks, and 10 between Nanakuli and Ko Olina Beach Parks. The 10 drownings along the North Shore (from Haleiwa to Kahuku Point) included mostly (70%, or 7) residents. Five of these drownings occurred in 2011.

Figure 185. Ocean drownings on Oahu, by residence status of victims, 2007-2011.



Residents comprised two-thirds (66%, or 29) of the 44 ocean drowning victims in Hawaii County. Figure 186 shows that most (80%, or 12) of the 15 non-resident victims drowned along the western coast, including 6 from Kailua-Kona to Kahaluu Bay. All but 1 of the 12 victims who drowned on the eastern part of the island from Hilo to Puna were Hawaii residents. About three-quarters of the ocean drowning victims on Kauai and Maui counties were non-residents. Although there were drownings on most parts of Kauai, the 2 biggest concentrations were from Kolopa Cape to Waiohai Beach on the south shore (8 drownings), and from Kee Beach to Kilauea Point on the north coast (15 drownings). Most (92%, or 57) of the 62 ocean drownings on Maui County were on the island of Maui. There were 16 drownings (including 15 non-residents) from Kaanapali Beach to Hanakao Beach Park on the western coast, including 6 in 2011. There were 9 drownings (including 8 non-residents) from Makena Bay to Big Beach (Oneloa Beach), and another 4 drownings near Molokini Island. (The approximate location for five of the drownings could not be determined and therefore do not appear in the Figure: 2 each on Hawaii and Maui counties, and 1 on Kauai.)

Figure 186. Ocean drownings on Neighbor Islands, by residence status of victims, 2007-2011.



Nonfatal injuries

Hawaii residents comprised a slight majority (55%) of all patients treated for near drownings, but only 41% of those who were hospitalized (Table 43). There was no clear trend in the annual number of near drownings, which peaked in 2008 and 2009. Male patients outnumbered females by a nearly 3-to-1 ratio for both ED visits and hospitalizations. There were proportionally more male patients among Hawaii residents (76% of the total), compared to non-residents (68% of whom were males). ED patients were significantly younger on average than those who were hospitalized (31 vs. 40 years of age), with more than half (56%) in the 15 to 44 year age group. Only 20% of patients were under 15 years of age. (It was not possible to look at age-specific rate estimates since the age distribution of non-residents is not known. This also precludes age-standardized county rate comparisons.) Hospitalizations for near-drownings were relatively short (4.1 days on average), but the average charge was nearly 17 times higher than that for ED visits.

Table 43. Demographic and clinical characteristics* of patients (Hawaii residents and non-residents) with nonfatal injuries from near drownings.

	ED visits	hospitalizations	total
Residence status			
Hawaii resident	100 (61%)	30 (41%)	129 (55%)
non-residents	63 (39%)	43 (59%)	106 (45%)
Year of admission			
2007	143	67	210
2008	191	60	251
2009	187	74	261
2010	153	68	221
2011	140	94	234
average annual total	163	73	235
Patient gender			
Female	44 (27%)	21 (29%)	65 (28%)
Male	118 (73%)	52 (71%)	170 (72%)
Patient age			
infants	1 (0%)	0 (0%)	1 (0%)
1-4 y	15 (9%)	11 (15%)	25 (11%)
5-14 y	15 (9%)	5 (7%)	20 (9%)
15-24 y	38 (24%)	9 (12%)	47 (20%)
25-34 y	30 (18%)	6 (8%)	36 (15%)
35-44 y	23 (14%)	5 (7%)	28 (12%)
45-54 y	19 (12%)	9 (13%)	28 (12%)
55-64 y	17 (10%)	15 (21%)	32 (14%)

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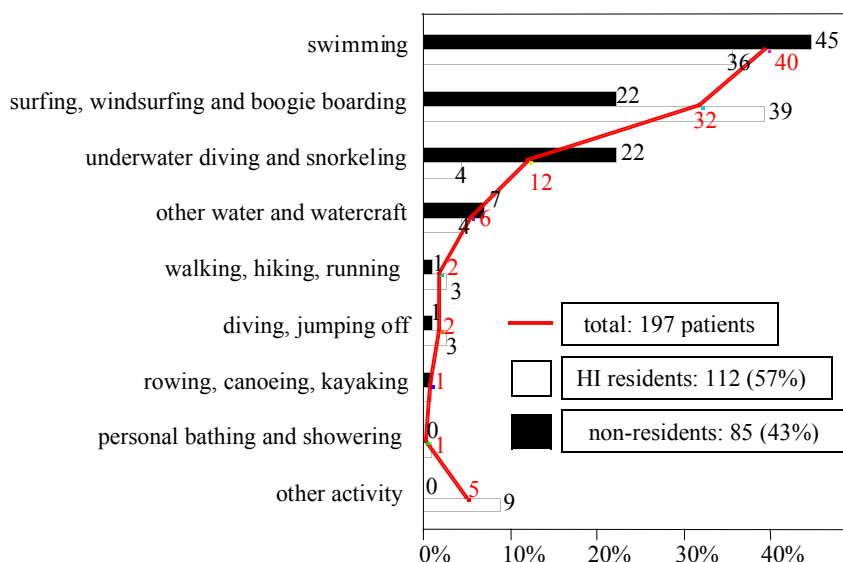
65-74 y	4 (3%)	7 (10%)	12 (5%)
75-84 y	1 (1%)	3 (5%)	4 (2%)
85+ y	0 (0%)	1 (2%)	1 (1%)
Length of care and financial charges			
Ave. length of stay (days)	1.0	4.1	1.9
Total number of days	163	295	457
Average charge	\$1,679	\$28,508	\$9,954
Total charges	\$0.3 million	\$2.1 million	\$2.3 million

*Statistics are annual averages over the 2007-2011 period.

Activity codes were included in 43% (197) of the 455 records related to near drownings for the 2010 to 2011 period. This proportion was significantly greater for ED records (50%) compared to inpatient records (31%). Records from Kauai hospitals were significantly more likely to contain activity codes (74%, based on only 35 records) compared to hospitals in any other county (33% to 43% of records).

Swimming (40%) and “surfing, windsurfing and boogie boarding” (32%) were the most common activities for the patients overall, although swimming was a more likely cause among non-residents, while the latter activities were more common among residents (Figure 187). Near drownings related to underwater diving and snorkeling were significantly more common among non-residents (22%) compared to residents (4%). “Surfing, windsurfing and boogie boarding” were more common activities for near drownings treated in the ED setting (36%), compared to those requiring hospitalization (20%). About one-quarter (24%) of the hospitalizations were associated with “underwater diving and snorkeling”, compared to 8% of the ED visits. Male patients were twice as likely to have been “surfing, windsurfing and boogie boarding” (39%), compared to female patients (18%). Patients who had been “surfing, windsurfing and boogie boarding” were significantly older than those who had been swimming (36 vs. 25 years of age, on average), but significantly younger than those who had been “underwater diving and snorkeling” (50 years of age).

Figure 187. Activity of patients treated for near drownings in Hawaii, 2010-2011.



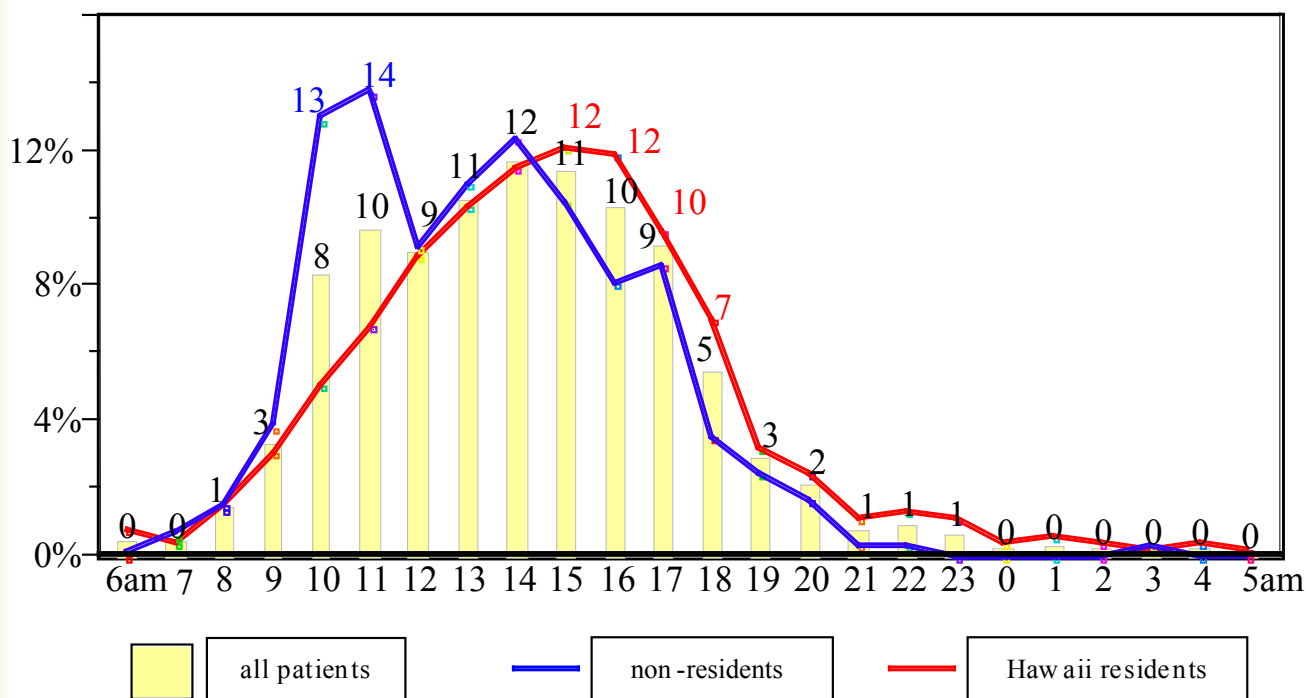
*Includes only hospital records with specific Activity codes, approximately 43% (197) of 455 total records for 2010 through 2011. Codes were more likely to be present in ED records (50%) compared to inpatient records (31%). Number in parentheses is annual average number of patients.

EMS responded to 921 near drownings over the 5-year period, including 544 (59%) among Hawaii residents and 377 (41%) non-residents. (Excluding 41 records for patients with unknown resident status, 18 who were transferred to other EMS units (to avoid double-counting of injuries), and 86 patients who were described as dead on arrival.) These were 896 separate incidents, as 97% involved a single near drowning. The non-resident group consisted mostly of patients from other United States (82%, or 308), and 69 (18%) residents of foreign countries.

Almost all (94%) of the incidents occurred during day time hours, including 80% between 9:31 a.m. and 5:29 p.m. (Figure 188). The most common time for incidents among non-residents was between 9:31 a.m. and 11:29 a.m. (27%), while the peak time for residents was 12:31 p.m. to 4:29 p.m. (46%). Sunday was the most common day of the week (21%), followed by Saturday (16%); the total varied between 12% and 13% for weekdays. About 43% of the near drownings occurred in bodies of water, which could include both freshwater and saltwater environments. About one-third (30%) were in patient residences (10%), public buildings (12%), hotels (5%), and health care facilities (3%). Most (69%, or 36) of the 52 night time incidents occurred in these types of environments. Another 16% were in “recreation areas”, which could presumably include both indoor and outdoor settings.

Figure 188. Time distribution of EMS-attended near drownings, by patient residence, 2007-2011.

(Horizontal scale indicates time of EMS dispatch, rounded up to nearest hour (military time scale, starting at 6:00am).
Vertical scale indicates percent of all incidents, rounded to nearest whole number.)



The distribution of incidents on Oahu was similar to that among Hawaii residents (page 130), with high numbers in the Waikiki, North Shore, Hawaii Kai, Ala Moana, and Waianae areas (Figure 189). The North Kona district again had the highest total in Hawaii County, while the incidents on Kauai were widely distributed (Figure 190). About half (53%) of the incidents on the island of Maui were in the Lahaina district. There were also 10 incidents on the island of Lanai and 8 on Molokai (not shown on the Figure).

Figure 189. Number of EMS-attended drownings and near-drownings on Oahu and eastern Oahu (bottom map), by Neighborhood Board, 2007-2011.

(Percent of all EMS-attended drownings/near-drownings in the state is shown in parentheses.)

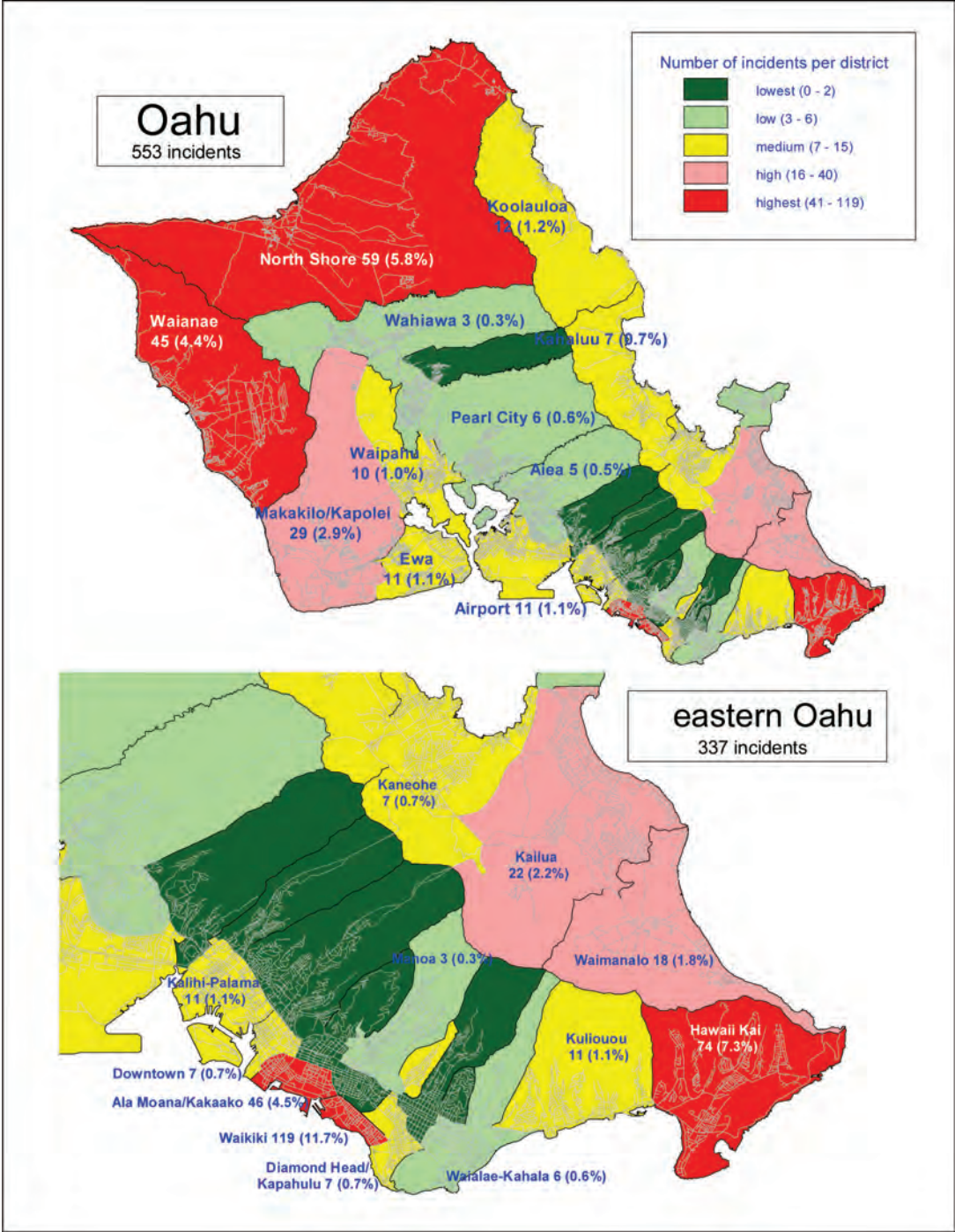
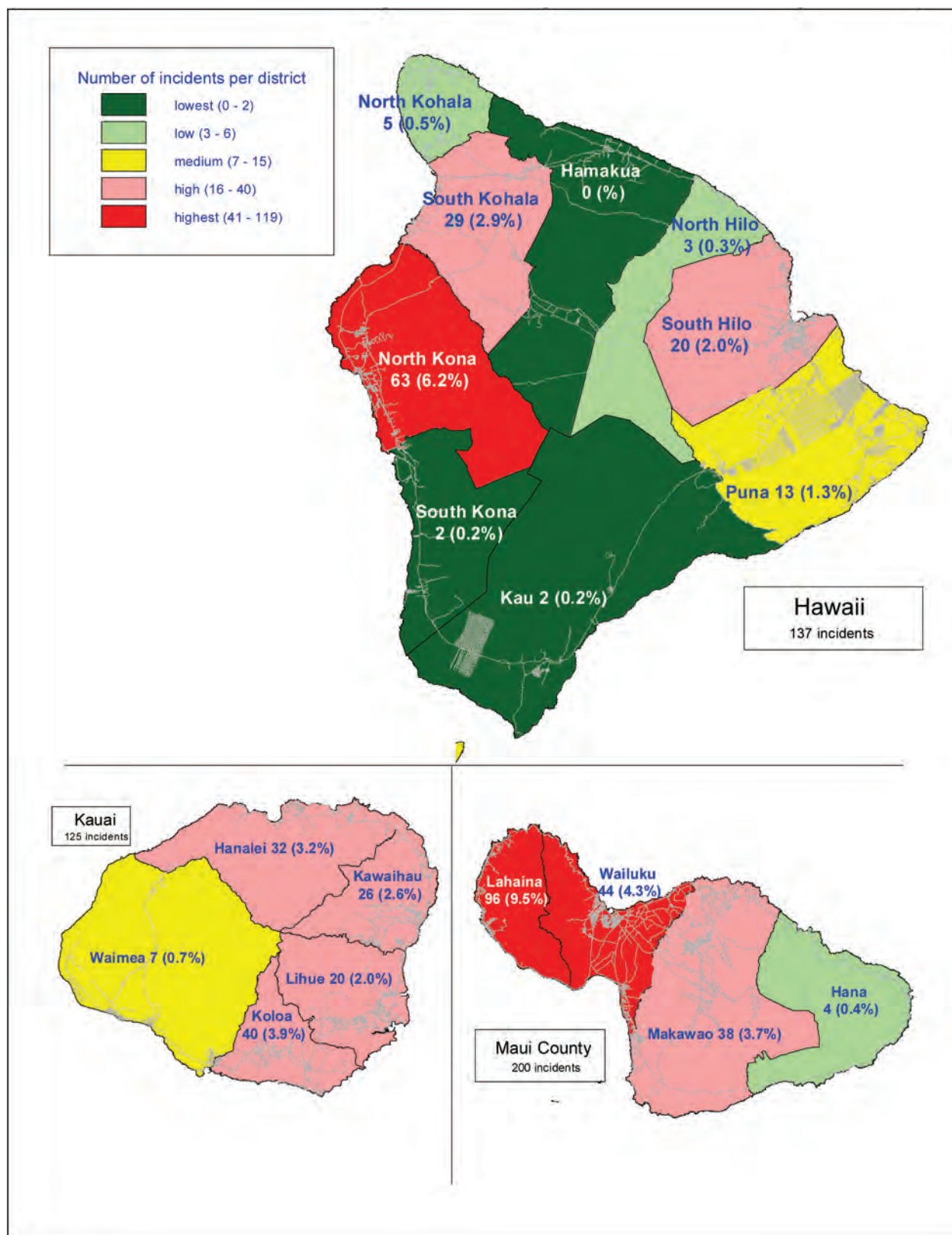


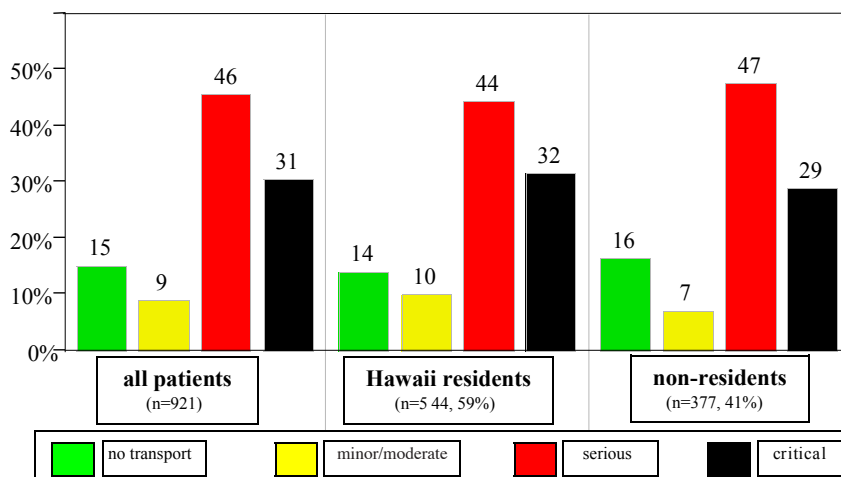
Figure 190. Number of EMS-attended drownings and near-drownings on Neighbor Islands, by district, 2007-2011.

(Percent of all EMS-attended drownings/near-drownings in the state is shown in parentheses.)



Most (77%) of the patients were either transported in “serious” (46%) or “critical” (32%) condition (Figure 191). There were no significant differences in the distribution of patient condition between residents and non-residents. Patient condition was not associated with gender, incident location, or the time of day of the near drowning or the day of week. There was a clear association with patient age, however, as patients who were released at the scene or transported in “minor” condition were significantly younger (31 years, on average) than those transported in “serious” condition (38 years). The latter were significantly younger than patient who were transported in “critical” condition (47 years, on average).

Figure 191. Distribution of injury severity/transport status of EMS-attended near drownings, by patient residence, 2007-2011.

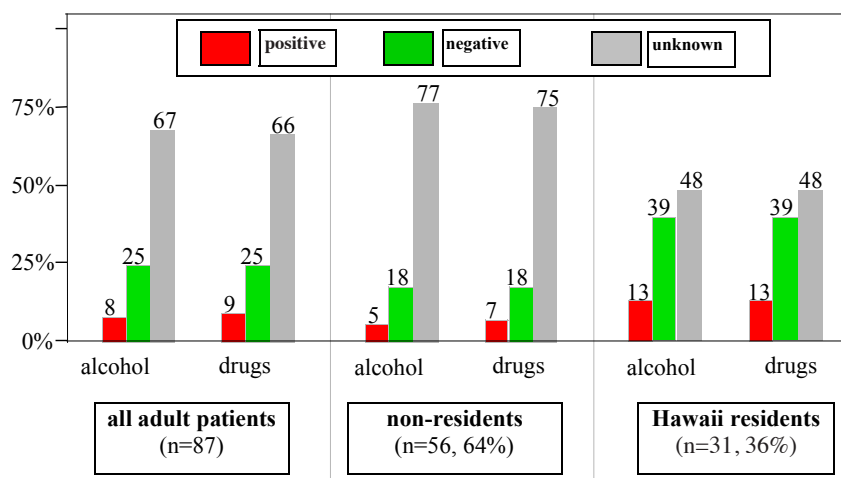


Probable alcohol use was noted for only 4% (33) of the patients. This proportion did not vary significantly by patient gender, residence status, or by county or day of week of incident. There were also no significant associations between patient age or disposition and their use of alcohol, although these comparisons are limited by small numbers. Near drownings that occurred during night time hours were significantly more likely to involve alcohol consumption than day time incidents, however (21% vs. 3%).

Trauma Registry data

Only 8% of the adult-aged (18 years and older) HTR near drowning patients were positive for alcohol, and only 9% tested positive for illicit drugs, although there was no toxicological testing for about two-thirds of the patients (Figure 192). Substance use was somewhat higher among resident patients, although this comparison is limited by the small sample sizes and the lack of testing. Five patients tested positive for narcotics, 4 for THC, and 1 for amphetamines. Considered together, 14% (12 of 87) of the patients tested positive for either alcohol or drugs. All 7 of the patients who had used alcohol were males. Only 3 of these patients had a BAC over 0.08%. It was not possible to examine the association between alcohol use and risk of mortality since the former was known for only 19% (5) of the 27 patients who ultimately died.

Figure 192. Alcohol and/or drug use (percent) among adult-aged patients treated for near drownings in the Hawaii Trauma Registry, by residence, 2008-2011.



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